WORLD PETROLEUM

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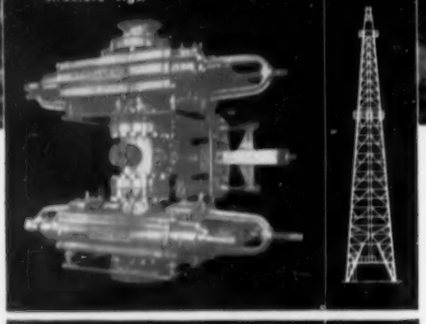
Twenty-five years of service to the International Petroleum Industry

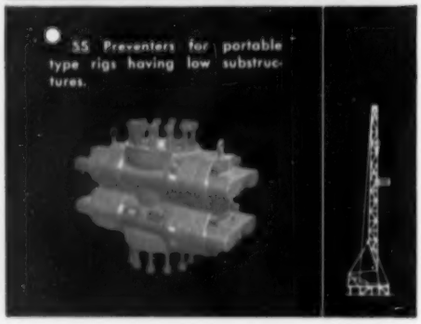
JUNE 1955

Fourth World Petroleum Congress, Rome 1955

● QRC Preventers and HCR Flowline Valves for high substructure rigs.



● 55 Preventers for portable type rigs having low substructures.



Blowouts still happen . . . as witnessed above . . . even on the best regulated rigs, but Cameron Drilling Control Equipment, in the hands of safety-conscious operators, has gone a long way toward eliminating blowouts. As drilling depths have increased, so have well pressures, and the need for more dependable pressure control equipment. Constant research and improvement in this field has enabled Cameron not only to keep abreast but to keep ahead of the industry's needs.

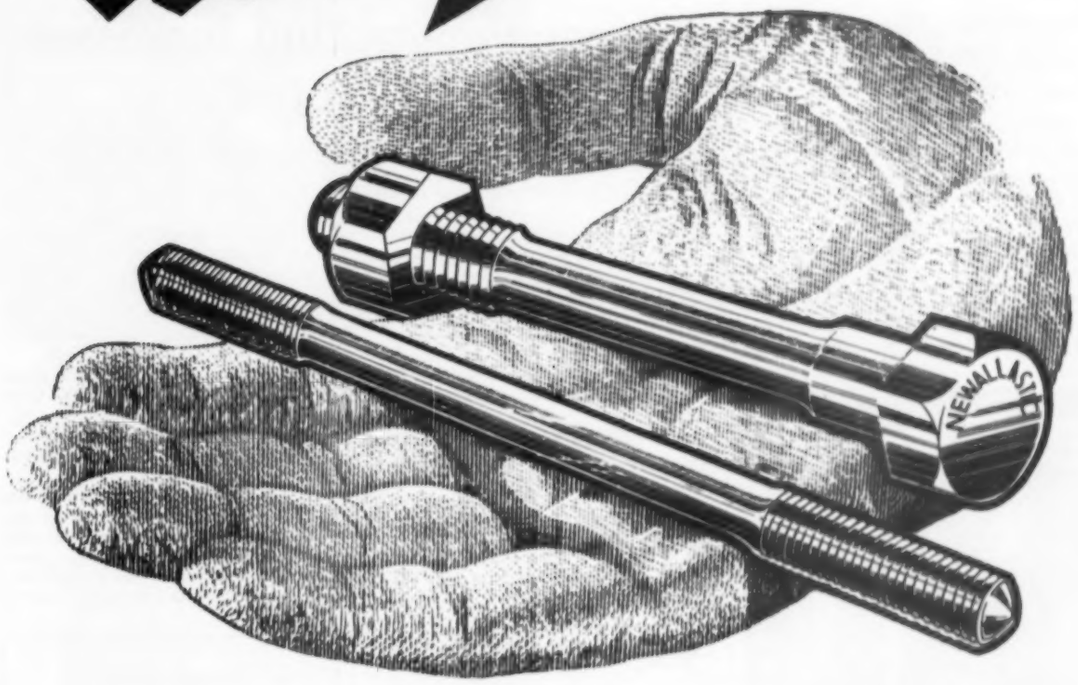
Cameron

IRON WORKS, INC.

P. O. Box 1212, Houston, Texas

Export Office: 7912 Empire State Bldg., New York City. In England: British Oilfield Equipment Co., Ltd., Time & Life Bldg., New Bond Street, London W. 1 England.

Unique



"Newallastic" bolts and studs have qualities which are absolutely unique. They have been tested by every known device, and have been proved to be stronger and more resistant to fatigue than bolts or studs made by the usual method.

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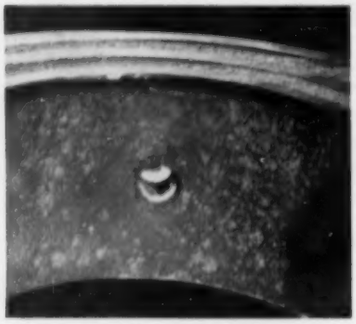
Service
Anywhere Anytime

New Services • • • New Tools • • • New Methods • • • Outstanding Results

New Burrless Cap for Ogival Bullet Provides Burr-Free Penetration

The new Burrless Bullet Cap is an exclusive McCullough feature. Inserted over the point of the improved ogival bullet at the time the perforator is loaded, it provides a completely burr-free hole on the inside surface of the perforated casing. Depth of penetration is not affected. Burr-free holes reduce the need for subsequent scraping and insure free passage of swabs, packers or other close fitting tools.



Unretouched photo above shows three string penetration by ½" Ogival Bullet with exclusive McCullough Burrless Bullet Cap. Note smooth, burr-free inner surface of pipe.

New Bulletin Available on M-3 Guns

This four-page, illustrated bulletin, No. 203, describes recent improvements in M-3 Bullet Perforator design and introduces the new, deeper penetrating Ogival Bullets. It gives specific examples of increased firing power and deeper penetration as experienced in competitive tests. Advantages, general characteristics, sizes, etc. are also given.

Request Bulletin No. 203 from McCullough Tool Company, 5820 South Alameda Street, Los Angeles 58, California.

Deeper Penetration Increases Production 2700 B/D

McCullough M-3 Bullet Guns Perforate 411 Feet of Pay Zone to Increase Production 245%

Excellent results obtained by the improved M-3 Bullet Perforator were dramatically illustrated by a recent field report from McCullough's Bakersfield Branch area.

M-3 Guns firing improved Ogival Bullets perforated 411 feet of oil zone for a 2700 B/D increase in production.

This well had previously been perforated by another service company for 1100 barrels per day. However, the operator believed better production was possible and called McCullough to re-perforate.

McCullough Service Crew made 17 runs with 3⅜" O.D. double 20-shot M-3 Guns, 14 runs with 3⅜" O.D. double 10-shot M-3 Guns and 8 runs with 3⅜" O.D. M-3 Guns one shot every two feet—a total of 39 runs in 39½ hours rig time.

A total of 1,000 improved ½" Ogival Bullets were shot in 5" O.D. 15 lb. cemented casing between 10,565' and 10,976'. Production increased from 1100 to 3800 barrels per day—a 245% gain.

Results like this can only be obtained by deepest penetration—penetration that reaches far out into the pay zone; exposes more productive formation; gets more oil—the kind of penetration you get only from McCullough M-3 Bullet Perforators.

McCullough Opens Two New Branches In Mountain Area

McCullough Tool Company has just opened new service branches at Westhope, North Dakota and Grand Junction, Colorado.

Both branches are fully equipped to render all McCullough wire line and fishing tool services to the rapidly expanding oil industry of the Rocky Mountain area.

Experienced crews, dependable equipment and skilled service are available on a twenty four hour basis.

McCullough M-3 Outshoots Premium Bullet Guns

In a very recent series of competitive tests, set up and supervised by a major oil company, regular improved McCullough M-3 Bullet Perforators outshot the premium priced guns of two other service companies. Here are the results:

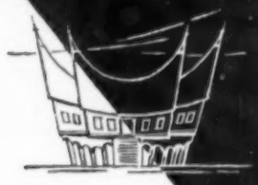
	Average Penetration into Special Targets
McCullough	5¼"
Company A	4⅜"
Company B	4⅛"

McCullough TOOL COMPANY

LOS ANGELES
HOUSTON
EDMONTON

WORLD PETROLEUM for June, 1955. Vol. 26, No. 6, June, 1955. WORLD PETROLEUM is published monthly by Mona Palmer, Trustee under the will of Russell Palmer, 604 Fifth Ave., New York 20, N.Y. Authorized as Second Class Matter, P.O. Dept., Ottawa, Canada. Subscription rate: $5.00 per year, single copies $1.00.

HOLLAND—Typical of Holland's modern transportation facilities is the "Koningin Juliana." This palatial Diesel-powered ferry carries 75 automobiles and trucks and 2,000 passengers between the islands of Zeeland province. The "Koningin Juliana" is lubricated exclusively with Caltex products. Caltex is proud of its share in such advances in the transportation system of this historic land.



INDONESIA—Exploring and drilling for oil in the Minas field, Caltex employs mostly nationals, a Caltex policy in all lands. Men—like this surveyor's helper—are trained in the many skills required by the oil industry, all of which give higher income opportunities. The Republic of Indonesia benefits through development of its resources, producing new government revenues.

SOUTH AFRICA—Fabulous land of gold and diamonds, South Africa is experiencing vigorous growth and modernization. Here in the shadow of the famous "Table Mountain" is the warehouse area of the Caltex Cape Town terminal—storage place for the fine fuels and lubricants for increasing numbers of motorists who "Travel the Caltex Way."

CALTEX serves the people of 67 lands

In 67 lands, across half the world, through such developments as these, Caltex is able to supply better fuels and lubricants for industry, for agriculture, and for motoring millions. These require a continual investment of funds and skills, backed by a faith in a better future for free nations.

CALTEX

Petroleum Products

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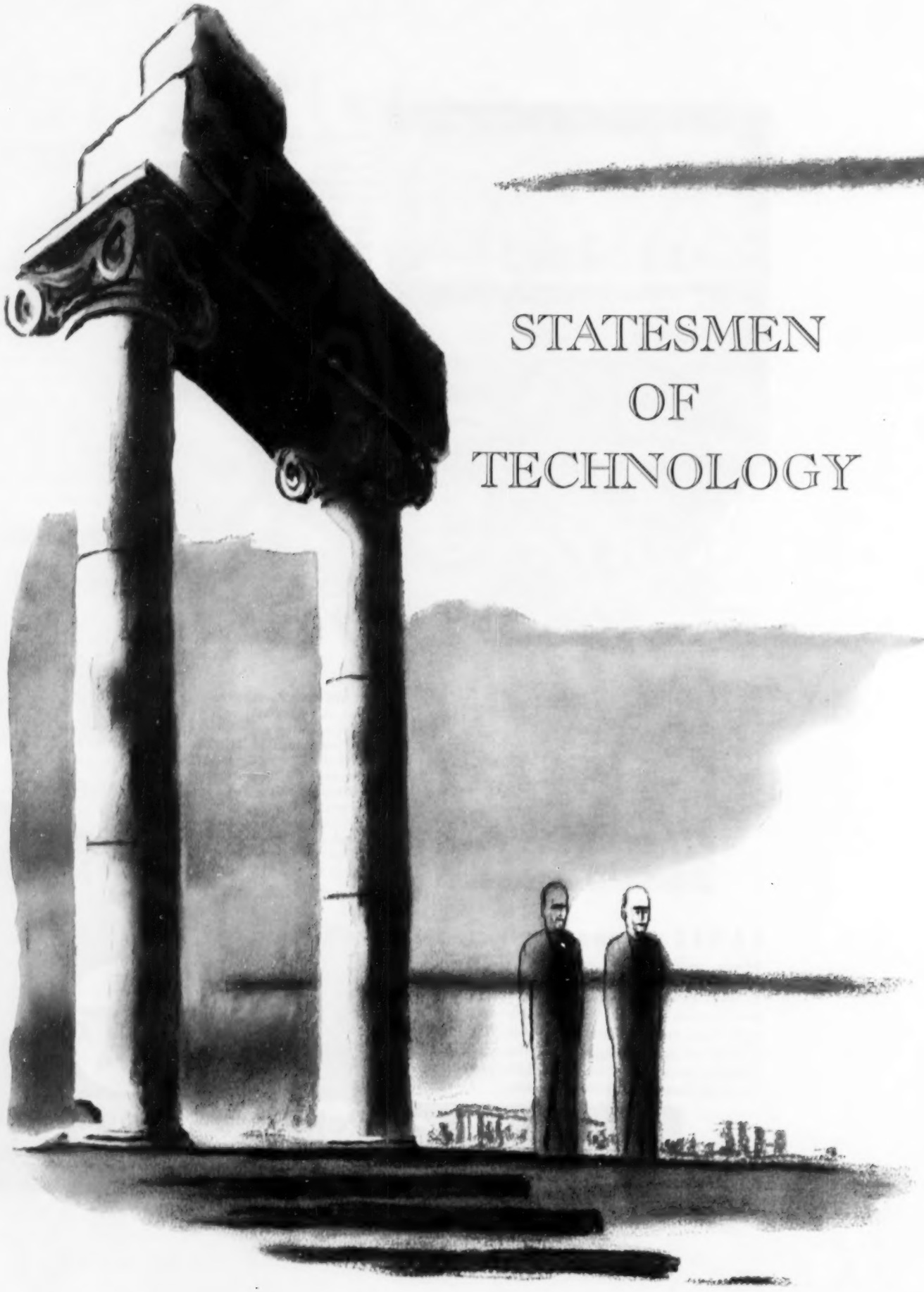

STATESMEN OF TECHNOLOGY

within the shadows of the ancient Roman Forum an unusual type of diplomacy is at work.

Meeting at the Fourth World Petroleum Congress, representatives from many countries have assembled in Rome to discuss mutual problems and to survey the latest developments in the science of petroleum. By this means, the free exchange of ideas and experiences is facilitated among men who are drawn together by the universal desire for progress and success.

And success will be theirs . . . success that will be measured in far greater terms than in the advancement of an industry. For, with their unhampered search for new ideas every member of the Congress becomes a statesman for the free world . . . statesmen of technology . . . and truth.

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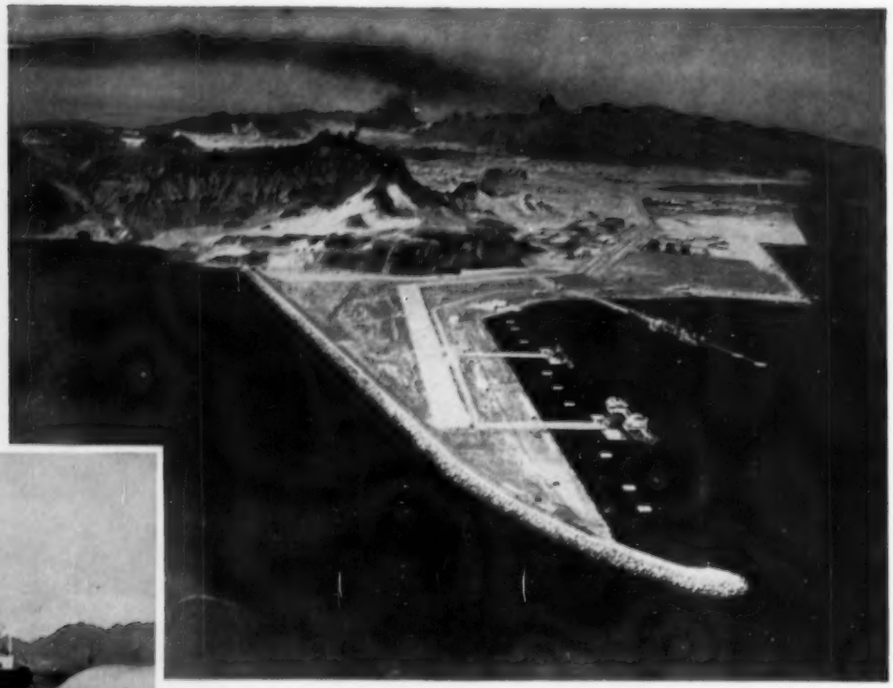

Aerial view showing the Oil Harbour and Port Installation at The British Petroleum Company's New Aden Refinery.

Below :
The first tanker berthing at Aden Oil Harbour—Four months ahead of schedule.

Main Contractors for Harbour :

GEORGE WIMPEY & CO., LIMITED

Consulting Engineers :

Messrs. RENDEL, PALMER & TRITTON

THE WIMPEY ORGANISATION

HAS SUCCESSFULLY CARRIED OUT EVERY ASPECT OF WORK CONNECTED WITH OILFIELD DEVELOPMENT, REFINERIES AND OIL PORT INSTALLATION AT HOME AND OVERSEAS

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SINGAPORE · TURKEY

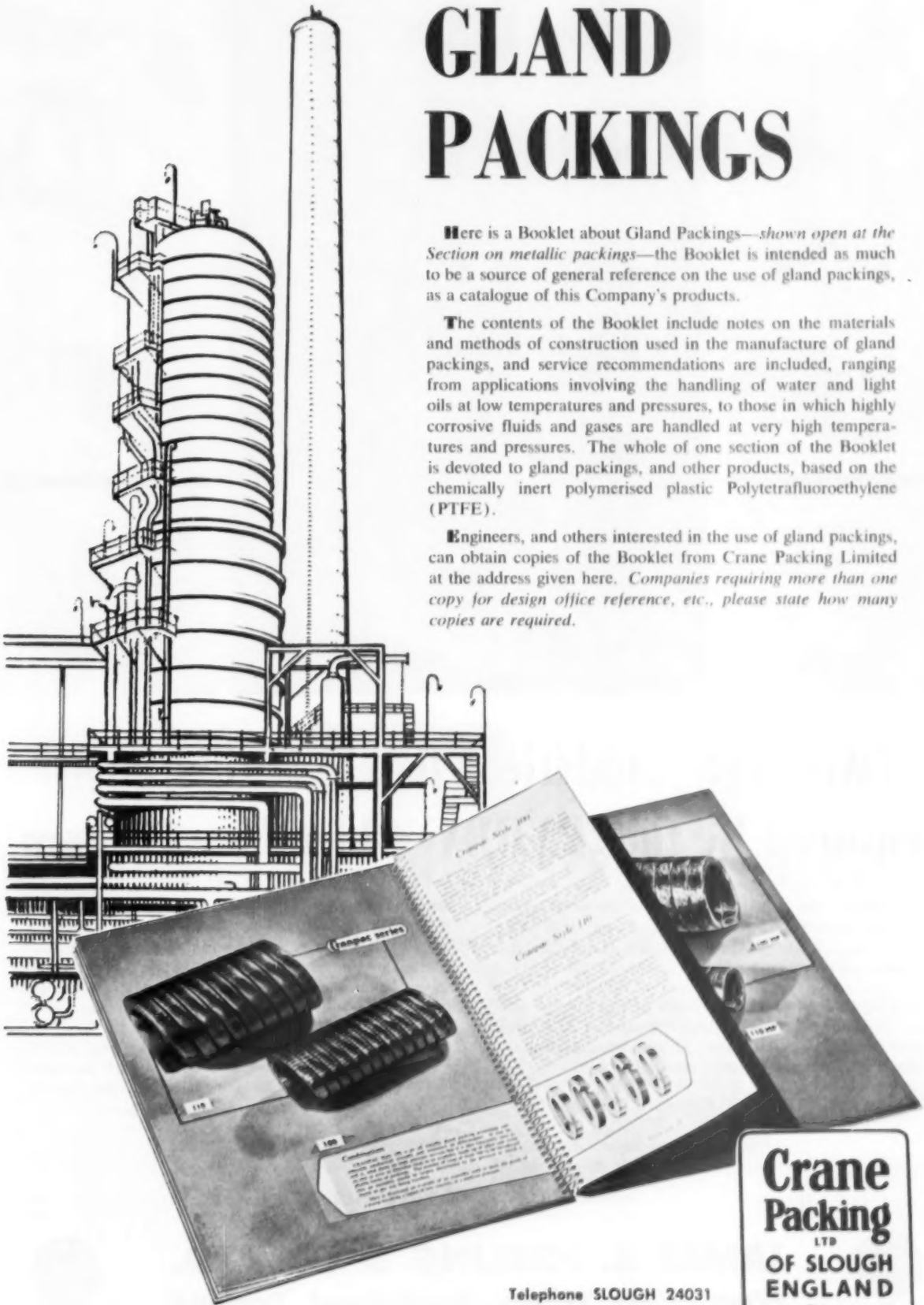
GEORGE WIMPEY & CO., LIMITED, HAMMERSMITH GROVE, LONDON, W.6

GLAND PACKINGS

Here is a Booklet about Gland Packings—*shown open at the Section on metallic packings*—the Booklet is intended as much to be a source of general reference on the use of gland packings, as a catalogue of this Company's products.

The contents of the Booklet include notes on the materials and methods of construction used in the manufacture of gland packings, and service recommendations are included, ranging from applications involving the handling of water and light oils at low temperatures and pressures, to those in which highly corrosive fluids and gases are handled at very high temperatures and pressures. The whole of one section of the Booklet is devoted to gland packings, and other products, based on the chemically inert polymerised plastic Polytetrafluoroethylene (PTFE).

Engineers, and others interested in the use of gland packings, can obtain copies of the Booklet from Crane Packing Limited at the address given here. *Companies requiring more than one copy for design office reference, etc., please state how many copies are required.*



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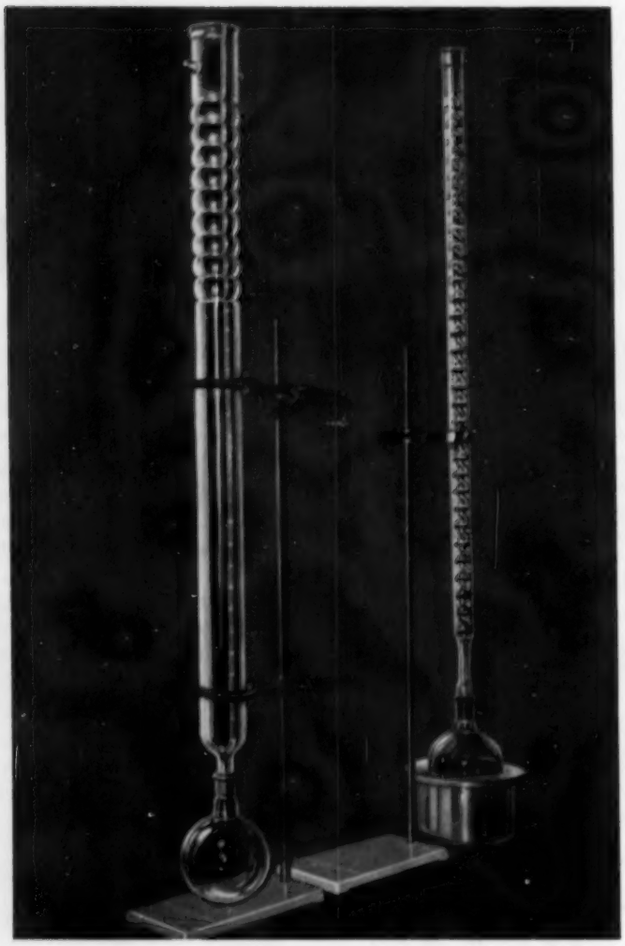

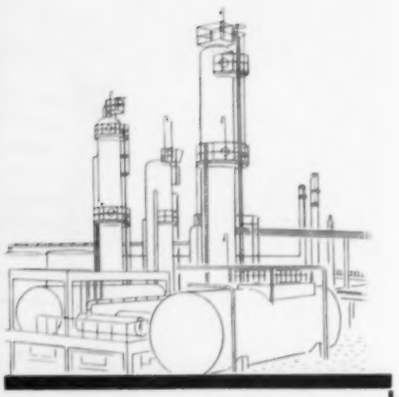

Accurate analytical batch distillations ensured by the 'PYREX' Oldershaw Column

We repeat, the 'PYREX' Oldershaw perforated plate Column ensures accurate analytical batch distillations. Moreover, it is easy to operate, has low H.E.T.P., and is suitable for corrosive liquids.

Is of especial value for the analysis of hydrocarbon mixtures, combines low operating hold-up per theoretical plate, and a negligible static, or non-drainable hold-up, with a high capacity or reflux note.

The 'PYREX' Oldershaw Column is constructed of a series of perforated glass plates sealed into a tube. Each plate, with its exactly positioned holes of uniform bore, has a baffle to direct the flow of liquid, a weir to maintain a liquid level in the plate, and a drain-pipe. The first plate serves as the reservoir necessary to maintain a liquid seal for the drain-pipe from the first of the plates above.

Made of 1″ or 2″ diameter plates, to suit the specific application, the column has a silvered and evacuated jacket with expansion bellows and window. Every apparatus is tested fully at our works before despatch.

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Now purchased by a number of the major Oil Companies in Great Britain.

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THE ONLY MAKERS OF 'PYREX' BRAND GLASS IN THE UNITED KINGDOM

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The new plant shown above, now finished and in operation, permits us to fabricate stainless and alloy steels in a shop completely segregated from our carbon steel operations.

Purity is Paramount—From an experience of many years in making *both* carbon and alloy equipment for industry, it has been demonstrated that the ideal set-up is—*segregation*. For top quality it is better that high-grade alloy steels be not exposed to contamination by tools and equipment used to make ordinary carbon steel products.

Sun Ship's new Alloy Products Shop, therefore, marks a distinct step forward in a great and growing field. Chemical plants, oil refineries, atomic energy plants, and many other types of industry are finding more and more uses for equipment boasting the special strengths and virtues contributed only by alloy steels.

Every Size and Type—In this new shop we are working with all of the 300 or 400 series of alloys, clad steels and aluminum; and are fabricating such products as pressure vessels, tanks, towers, troughs, autoclaves, reactors, hoppers, kettles, platework and machinery. All sizes and types are handled; and pieces too long for delivery by rail can be shipped direct by water from our own docks on the Delaware.

Every Facility—The new shop is an integral part of Sun Ship's huge plant at Chester, Pa.—an impressive blend of steel fabricating shops, forge shops, boiler and tank shops, machine shops and every other facility needed for building the many types of made-to-order equipment required for modern industry.

For more specific information about our new Alloy Products Shop, for estimate, advice or a representative's personal call, just get in touch with our Sales Engineering Department. Your inquiry will receive prompt and expert attention.

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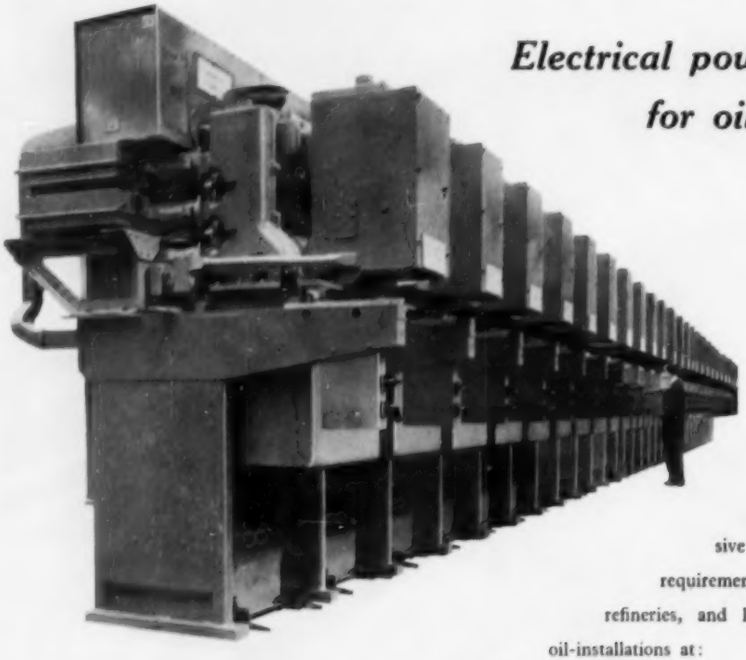

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Reyrolle switchgear with its comprehensive range covers all requirements for modern oil-refineries, and has been supplied to oil-installations at:

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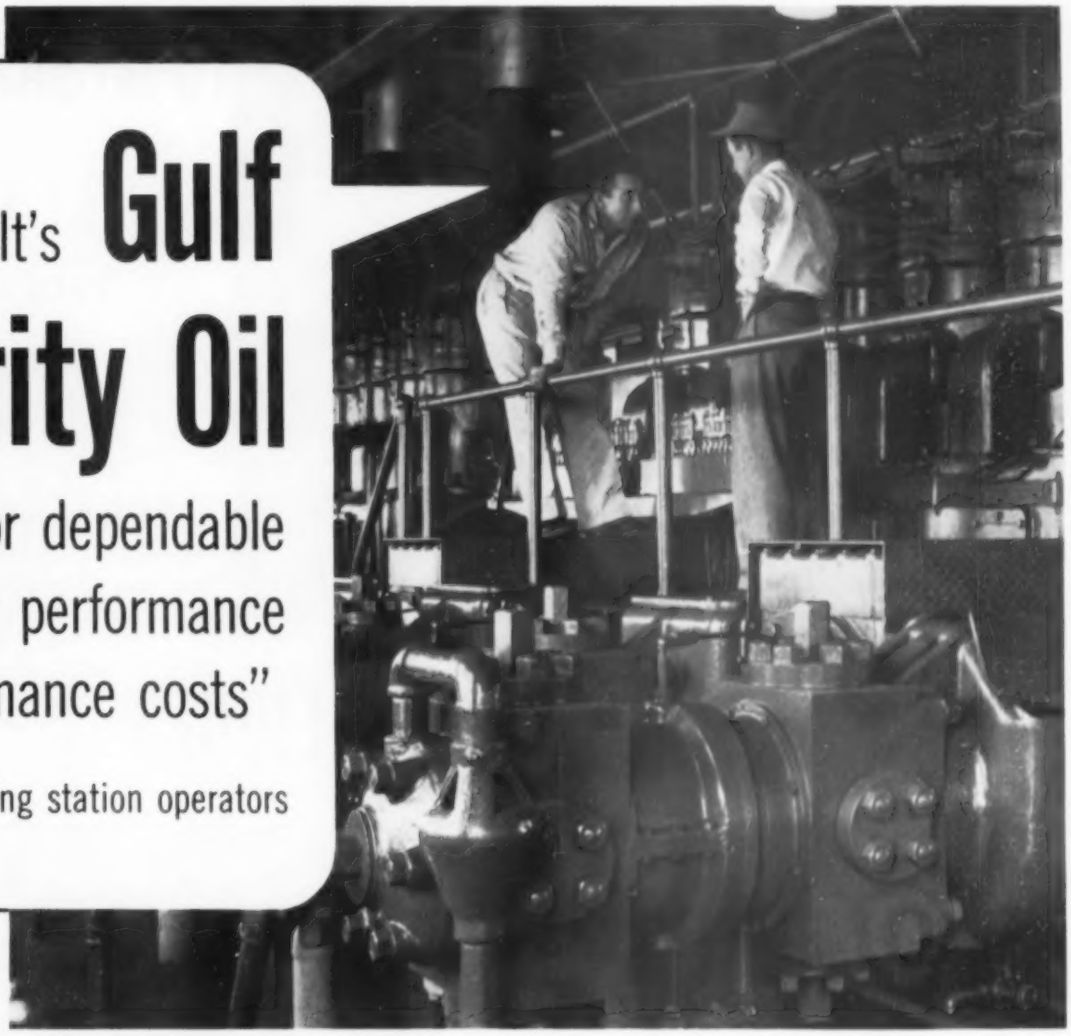
"It's Gulf Security Oil for dependable gas compressor performance and low maintenance costs"

say pumping station operators



Smooth, continuous operation is a must for these units in service at a South Texas gas compressor plant. They are responsible for the steady flow of essential natural gas through pipe lines to homes and industries as far north as Detroit and New York. Gulf Security Oil provides the sure, effective protection needed for cylinders and bearings in both engines and compressors.

You can depend on Gulf Security Oil to provide the proper lubrication that is so important to vital compressor units if operating troubles are to be prevented and maintenance costs kept low.

Gulf Security Oil has a record of outstanding performance in scores of gas transmission plants. After years of operation with this quality oil, the cylinders and piston rings of both the compressors and power assemblies show negligible wear. And few carbon deposits have formed on power cylinder ports and pistons.

If you are installing new compressor units, or feel that you're not getting the most effective lubrication possible for your present units, it will certainly pay you to try Gulf Security Oil. Contact your nearest Gulf Office and have a Gulf Sales Engineer call.

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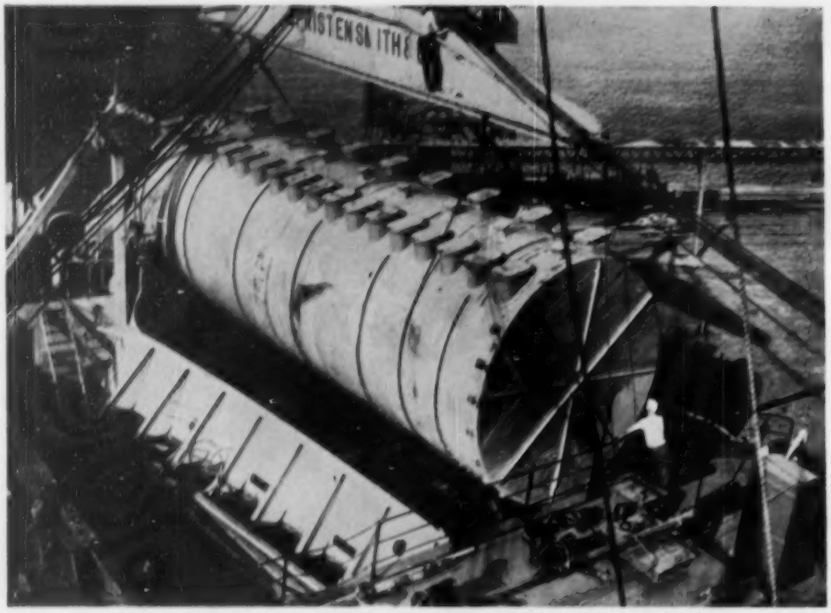

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C.N.P., Cubatao (Brazil)
CONDOR REFINERY, Milano (Italy)
ESSO STANDARD, Aruba (Dutch West Indies)
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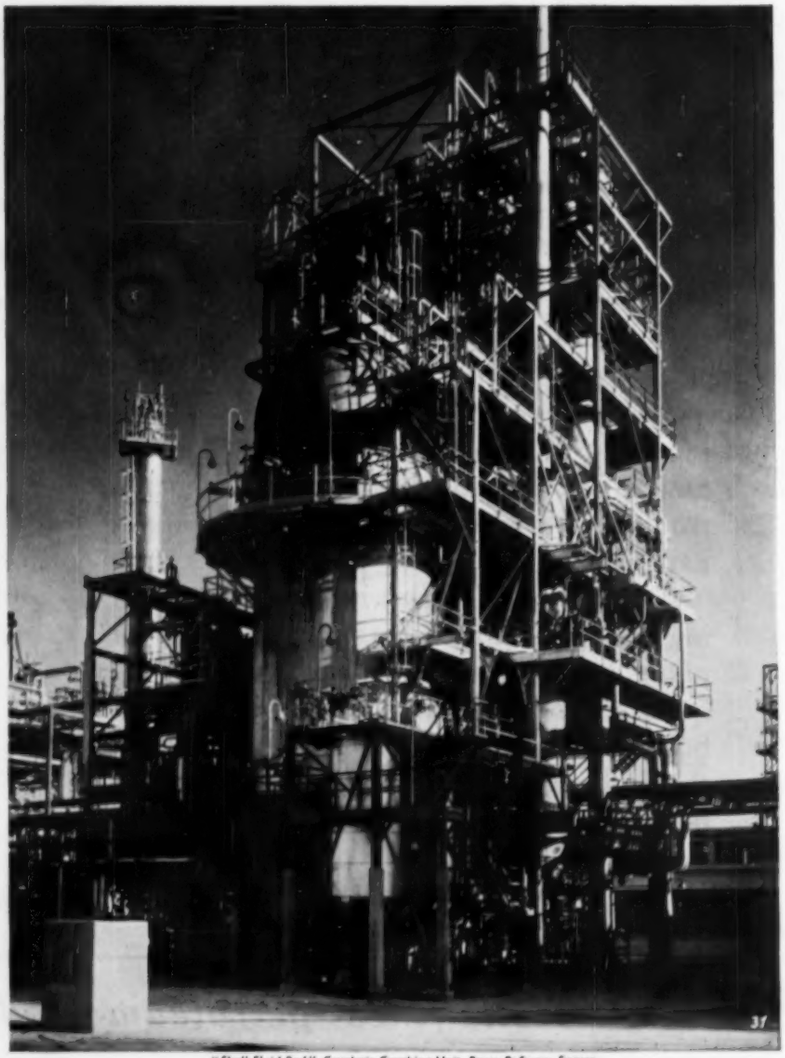

"Shell Fluid Bed" Catalytic Cracking Unit, Berre Refinery, France

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Process Engineers and Constructors for the Petroleum, Chemical and Petro-Chemical Industries

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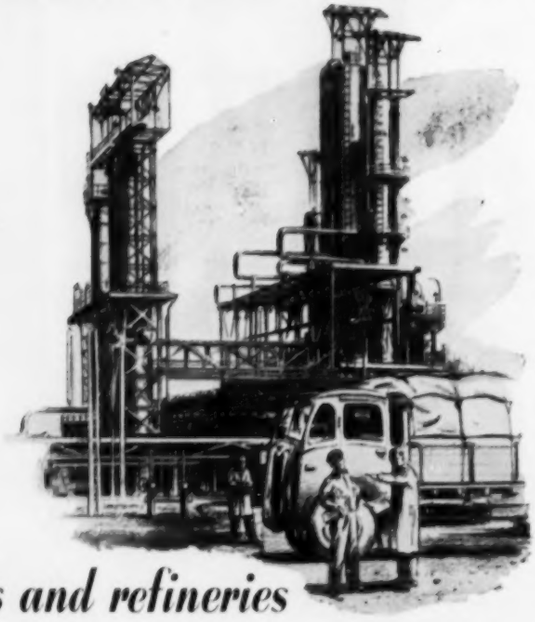

in oilfields and refineries

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BTH factories are exceptionally well equipped to make both ***STANDARD*** *and* ***SPECIAL*** *machines in large quantities*

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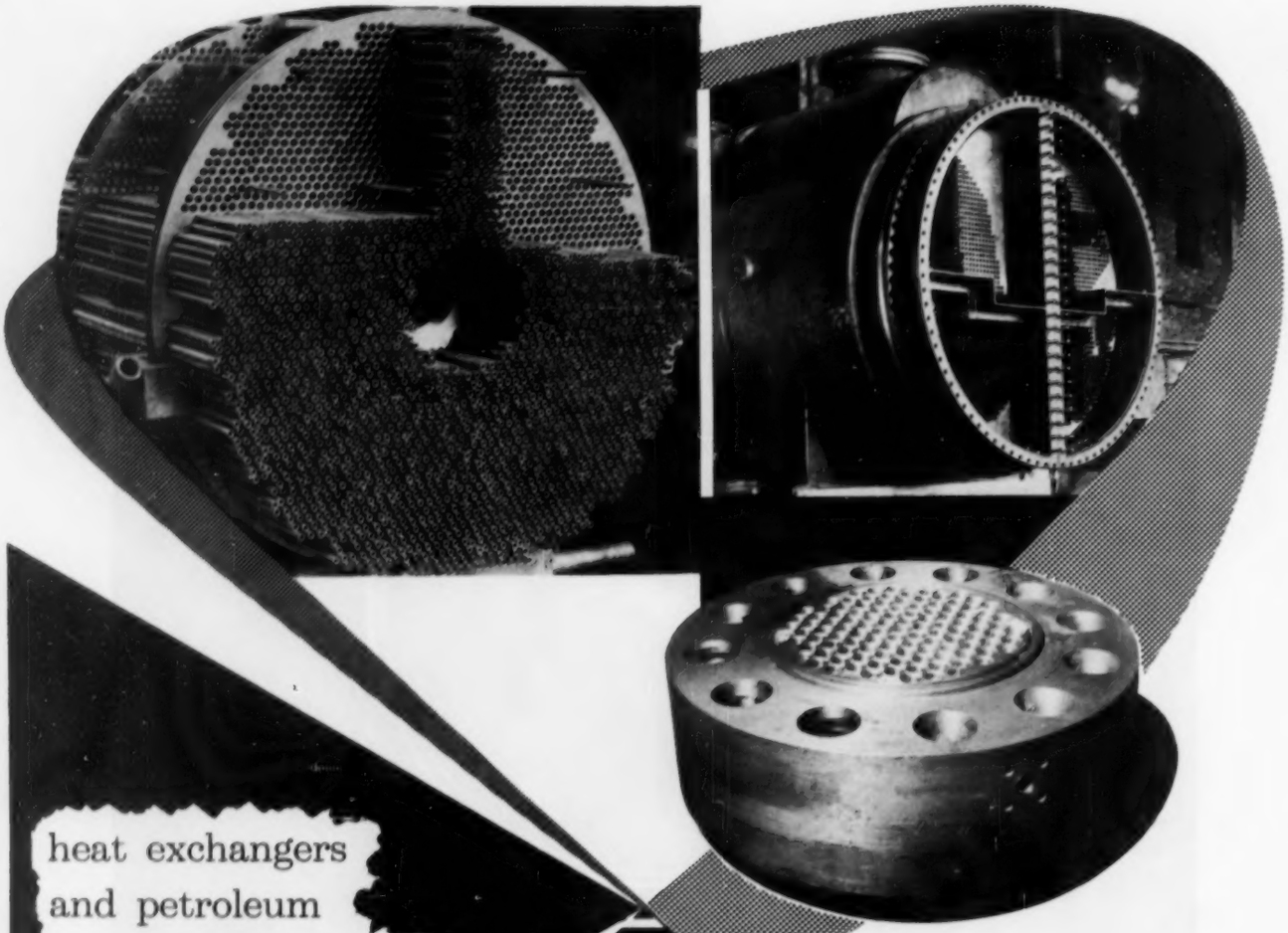
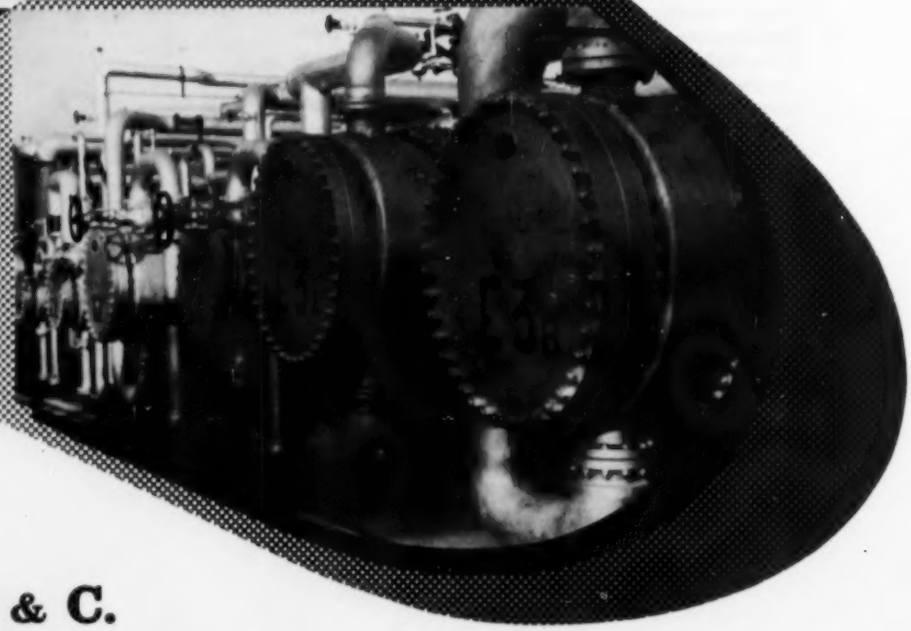


heat exchangers
and petroleum
industries equipment



D. BONALDI & C.

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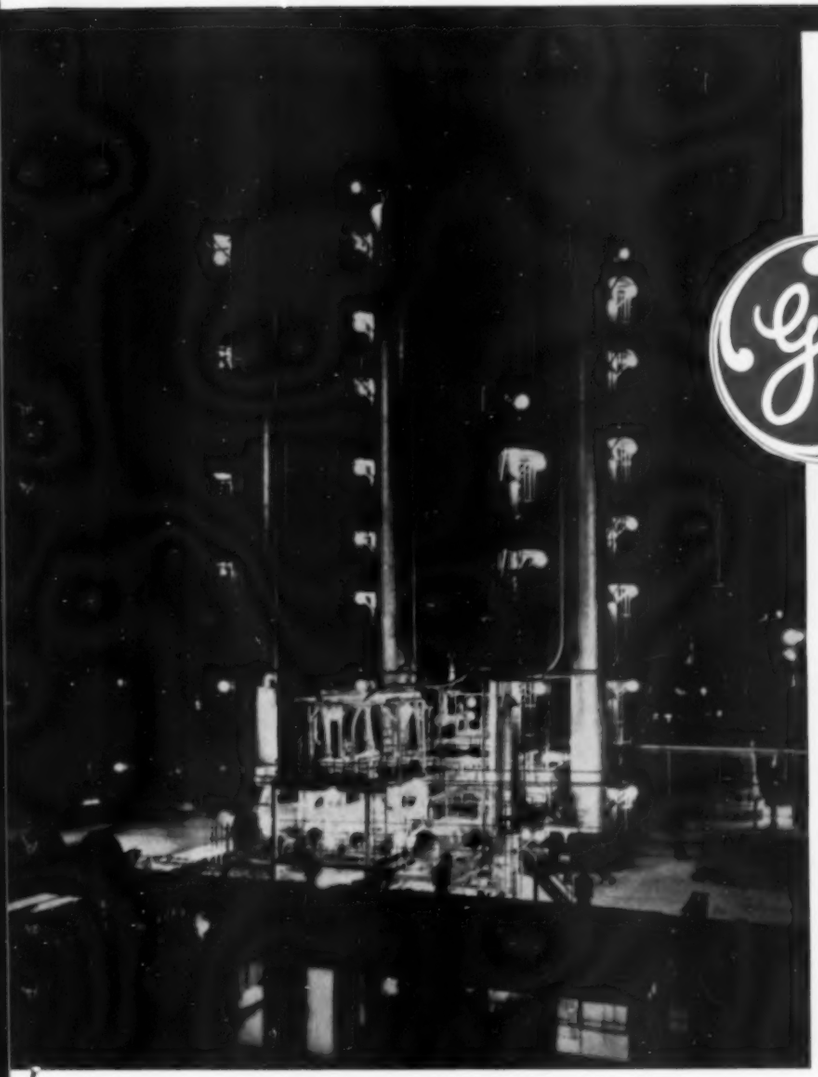

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• Continuous Operation •

IN THE REFINERY . . . Wider use of explosion-proof corrosion-resisting G-E motors and grouped controls—to simplify plant layouts, cut special construction costs; secondary selective distribution systems with G-E unit substations—to protect continuity of service at minimum cost; better protection against shutdowns with G-E selective tripping—to isolate faults on low-voltage circuits.

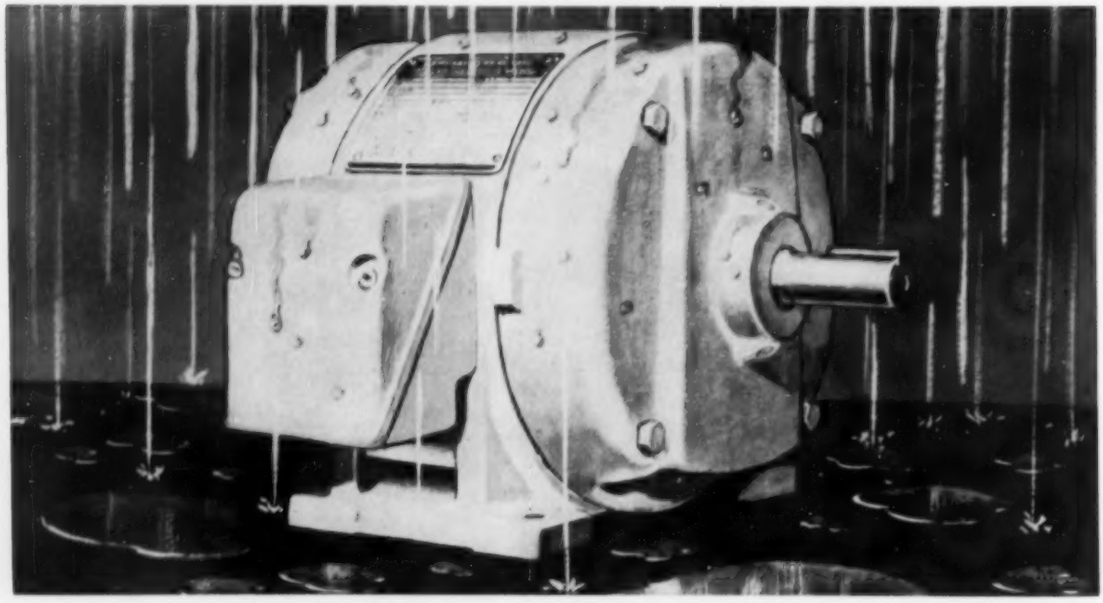
FOR PIPE-LINE PUMPING . . . G-E equipment will work together as an integrated system to meet your individual needs; reduces initial investment cost; cuts pumping station costs at reduced capacities, releases men for other duties, permits automatic control for simpler, more efficient operation, lowers maintenance and replacement costs.

If you are planning to build, expand, or modernize, let a team of General Electric engineers help you design an electrical system for top production and flexibility.

GENERAL ELECTRIC

G-E MOTORS ASSURE CONTINUITY OF PRODUCTION, SAFETY, PROFIT

General Electric builds an extensive line of motors, in the widest variety of types, sizes and ratings on the market. G-E motors are compact, sturdy, operate efficiently under severe mechanical strain in a large number of hazardous locations at a reasonable cost.



A more Fully Enclosed Dripproof Motor. Cast-iron end shields with ventilating openings at the base, plus louvered vents for exhaust outlets, give the Tri/Clad '55' extra physical protection. This added protection makes the new Tri/Clad '55' suitable for many applications where ordinary dripproof motors cannot be correctly applied.

TRI 55 CLAD ***Give Extra Protection Against Physical Damage, Electrical Breakdown, Operating Wear and Tear.***

The new redesigned G-E Tri-Clad motor line gives longer motor life, outdoors and in, with better performance and less maintenance. Installation is simplified with permanumbered leads which can be read instantly even when wires are taped or clipped. Lighter and smaller Tri-Clad motors in new NEMA frame sizes and ratings save you space and weight, reduce handling costs. The complete line includes dripproof motors especially suited for outdoor applications such as oil well pumping.

Water Shedding Stator Assembly. New non-hygroscopic insulation materials in the stator of the new General Electric Tri/Clad '55' motor resist moisture.

Revolutionary Insulation Gives Added Margin Of Protection Against Motor Failures, Reduces Maintenance Costs

For motors from 100 to 3000 hp, G.E. has developed a new insulation that is tougher and increases motor life by 50%. Called Polyex, the insulation is a balanced system of polyester films, together with new hydrocarbon resins. Polyex lasts 50% longer than Class A insulation in use today, has 7 times greater physical strength, 50% greater dielectric strength.

COMPLETE LINE OF CONTROLS BY G.E.

Designed by G-E engineers for your motors, G-E controls have safety features built-in . . . various types of enclosures protect personnel, make apparatus immune to dust, water and explosive gases. Co-ordinated starters, circuit breakers, overload relays protect motors under all over-load and short-circuit conditions. G-E Low-Voltage Motor Control centralizes auxiliary operation, is a simple system for controlling, from one point, starters for all low-voltage, auxiliary-driven motors. G-E controls are tamper-proof, shipped ready to install, in a wide range of ratings.

G-E motors and control can be located solely with reference to convenience, accessibility for maintenance, economy of space, and driving machinery. Because they are standard equipment, the initial cost is lower. In both high and low voltage control, you have an unusually broad range from which to select. Let an experienced G-E engineer help you choose the right combination for your special needs.

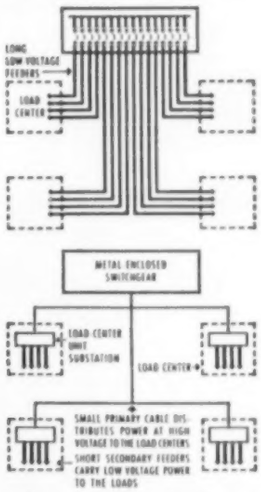
GENERAL ELECTRIC

—U. S. A.—

LOAD CENTER DISTRIBUTION KEY TO GREATER PROFITS

THE OLD WAY

THE LOAD-CENTER WAY


LONG LOW VOLTAGE FEEDERS
LOAD CENTER
METAL ENCLOSED SWITCHGEAR
LOAD CENTER UNIT SUBSTATION
LOAD CENTER
SMALL PRIMARY CABLE DISTRIBUTES POWER AT HIGH VOLTAGE TO THE LOAD CENTERS
SHORT SECONDARY FEEDERS CARRY LOW VOLTAGE POWER TO THE LOADS

LOAD CENTER DISTRIBUTION HAS TWO DISTINCTIVE FEATURES THAT SAVE YOU MONEY

1. Short secondary feeders to points of use, from small unit substations in electrical load center locations where power is stepped down to utilization voltage. Besides using less expensive secondary equipment and less cable, this system cuts line losses. Lower cost secondary switchgear is possible because of lower short circuit current.

2. Initial distribution of power at high voltages of 2.4 to 13.8 kv. Utilities have long recognized the inherent economy of delivering power at high voltages. Where total load cannot be met by a single small substation (1500 kva), two or more small load-center substations are used (rated 200 kva and up).

One Source Buying Means Greater Integration

With this modern load-center distribution system, basic units are standardized. Planning and ordering are simplified . . . installation is quick and easy.

TYPICAL UNIT SUBSTATION Complete metal-clad switchgear equipment showing, l. to r., centralized motor control, secondary switching air circuit breakers, Pyranol filled transformer, and incoming line section with metal-clad air circuit breakers and metering compartments.

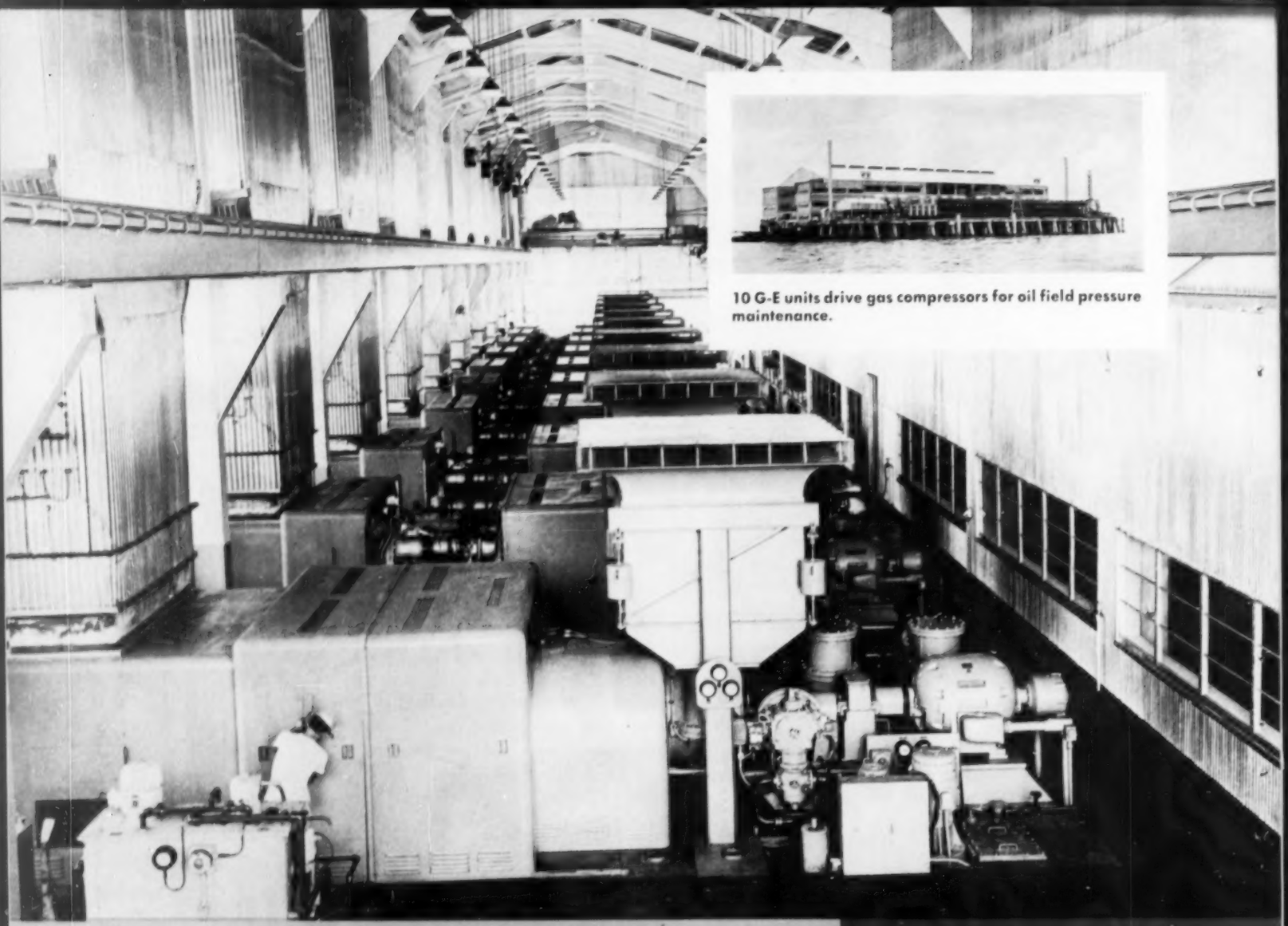
UNIT SUBSTATIONS cut your engineering and installation costs, since the substation components are co-ordinated by General Electric and the equipment is factory-assembled. Completely metal-enclosed for maximum safety, substations may be added when and where needed to care for increased load as it develops, can be located indoors or outdoors. There are many types of circuits from which you can choose, permitting the arrangement best suited to your specific needs. Because secondary feeders are short in the load-center system, the feeder voltage drop is low . . . rarely more than 2 or 3 percent. And the proper direction of voltage to all parts of your plant means better performance of lights, motors and heating devices, thus improving overall production efficiency.

G-E SWITCHGEAR insures strength and safety. Because it is standardized, all component parts are safely and conveniently accessible to give simpler operation. New flame-retardant material insulates circuit breaker, which has the maximum number of parts interchangeable among breakers of various ratings.

G-E CAPACITORS improve your power factor and thereby increase your feeder capacity without the necessity of purchasing extra distribution equipment.

GENERAL ELECTRIC

—U. S. A.—



10 G-E units drive gas compressors for oil field pressure maintenance.

G-E Gas Turbines Deliver Efficient Dependable Power

General Electric, with a factory devoted exclusively to gas turbine manufacturing, has a record-making total of over 675,000 hours (over 75 machine years) of successful commercial operation to its credit . . . accumulated on 100 gas turbines in five different industries. If you can use mechanical power, compressed air, heated exhaust gas, or all three, the G-E gas turbine will produce for you, too.

Gas Pipe-Line Pumping . . . At present, 41 G-E gas turbines are driving centrifugal compressors pumping natural gas through transmission lines. G-E gas turbines, designed specifically for this particular application have adjustable speed characteristics to meet varying gas flow requirements. Operating results indicate that G-E gas turbines are ideal for this application because of their low installation and operating costs and their inherent ability to produce extra power at ambient temperatures lower than 80°F.

Oil Field Pressure Maintenance . . . Gas turbines, driving centrifugal compressors, can return natural gas under pressure to oil-producing formations to maintain underground pressure and thus prolong or increase well flow. At the Lake Maracaibo station of the Creole Petroleum Company, the installation of ten G-E gas turbines, the largest concentration of gas turbine horsepower in the world, represents a new concept in oil field pressure maintenance. The proven reliability of G-E gas turbines was an important factor in their selection.

Power Generation . . . The gas turbine is also an economical and dependable means of power generation. Moreover, where use can be made in a cycle or manufacturing process of the gas turbines other products . . . compressed air or heated exhaust gas . . . very high overall cycle efficiencies can be obtained. The Shell Caribbean Petroleum Company uses two G-E gas turbines to supply power for its operations in Venezuela.

THESE ARE SOME OF THE MANY ADVANTAGES OF THE GAS TURBINE:

- **semi-automatic in operation; self-protecting**
- **provides up to 25% additional horsepower at low ambient temperatures**
- **has proved reliability**
- **requires simple station construction . . . steel base reduces installation costs still further**
- **inherent low operation and maintenance costs**
- **can meet varying requirements of flow in a gas pipeline by adjusting the speed**
- **low weight for high horsepower output**

Progress Is Our Most Important Product

GENERAL ELECTRIC

—U. S. A.—

PRINTED IN U.S.A. (13½M—5/53)

A MARK OF QUALITY AROUND THE WORLD

G-E representatives all over the world have been serving the petroleum industry for more than fifty years. See the one nearest you early in your planning.

ANGLO-EGYPTIAN SUDAN: The Sudan Mercantile Co. (Engrs.) Ltd., Khartoum
AUSTRALIA: Australian General Electric Proprietary Ltd., Sydney
BRAZIL: General Electric S.A., Rio de Janeiro
COLOMBIA: International General Electric S.A., Inc., Bogota
ENGLAND: International General Electric Co. of New York Ltd., Aldwych, London
INDIA: International General Electric Co. (India) Ltd., Bombay
IRAN: General Iranian Electric Co., Teheran
ITALY: Compagnia Generale di Elettricita, Milan
NETHERLANDS: Mijnssen & Company, N.V., Amsterdam
SAUDI ARABIA: The Arabian Trading Company, Jeddah
TURKEY: Teknik Ticaret Ltd., Ortakligi (TEKTICO), Ankara
ARGENTINA: General Electric, S.A., Buenos Aires
BOLIVIA: International Machinery Co. (Bolivia) S.A., La Paz
CHILE: International Machinery Co., Santiago
EGYPT: Eastern Electric Co. (S.A.E.), Cairo
FRANCE: International General Electric Co., Paris
INDONESIA: International General Electric Co. Inc. of Java, Djakarta
IRAQ: F. A. Kettaneh & Company, Ltd., Baghdad
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TRINIDAD and TOBAGO: Read & Massy Engineering Co., Ltd., Port-of-Spain
VENEZUELA: International General Electric, S.A., Inc., Caracas

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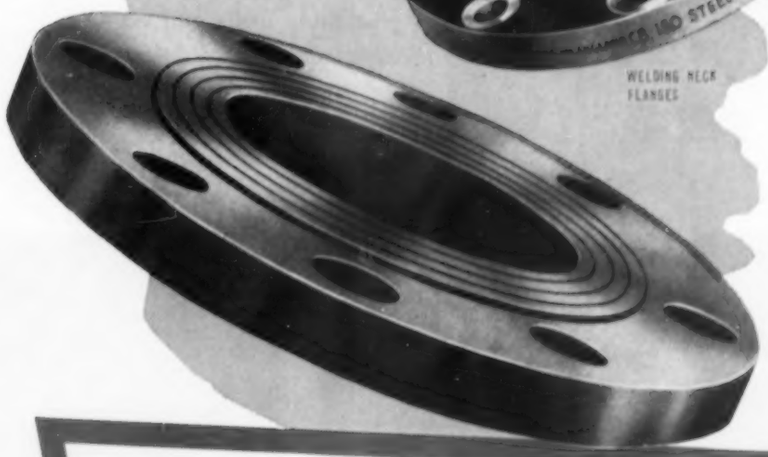
ARABIA

TEXAS

SEEN AROUND RIGS ALL OVER THE WORLD

SLIP ON FLANGES

WELDING NECK FLANGES



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SOLID FORGED WELDLESS STEEL

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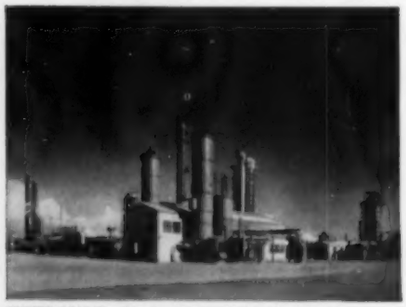
A WORLD OF PRACTICAL KNOW-HOW
in the design, engineering, construction and installation of complete refineries, individual processing units and refinery modernization

CANADA — Complete refinery with capacity of 23,000 barrels per day.

ENGLAND — Largest refinery in Britain, with capacity of 125,000 barrels per day.



UNITED STATES — Synthetic ammonia plant, producing 180 tons of liquid ammonia per day.

What Foster Wheeler's

WORLD-WIDE EXPERIENCE

in petroleum processing

means to you

The sun never sets on Foster Wheeler petroleum processing plants. From U.S.A. to the Philippines — from England to South Africa — modern refineries and processing plants designed and installed by Foster Wheeler are producing, every day, high quality petroleum products for free-world consumption.

During the past year, FW has placed in operation complete new refineries in U.S.A., South America, South Africa and the Philippines — plus many additional processing units including the largest crude distillation unit ever built and the highest capacity fluid cat cracker in the world. Work is continuing on similar projects in Brazil, Venezuela, England, France, Spain, Bahrein, Canada and the U.S.A. These world-wide operations are conducted jointly by Foster Wheeler and their subsidiary companies in Canada, England and France.

The *experience* which all of this represents is of vital importance to petroleum refiners *everywhere*. It means that virtually every forseeable design and construction problem has already been solved under a variety of conditions. Working with and training unskilled labor in far countries has developed streamlined and simplified construction procedures. And this specialized know-how is constantly being expanded, through research and development, to encompass the latest technological advances in the petroleum and chemical processing fields.

This valuable experience can save you time, effort and expense in any phase of refinery design, construction or modernization. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

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COLOMBIA, S. A. — Completely modernized refinery with capacity of 30,000 barrels per day.

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SOUTH AFRICA — Complete refinery installation — capacity, 15,600 barrels per day.

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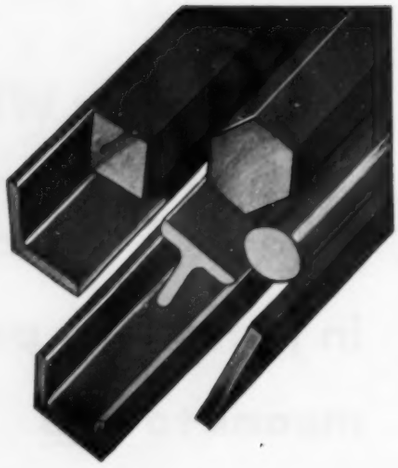

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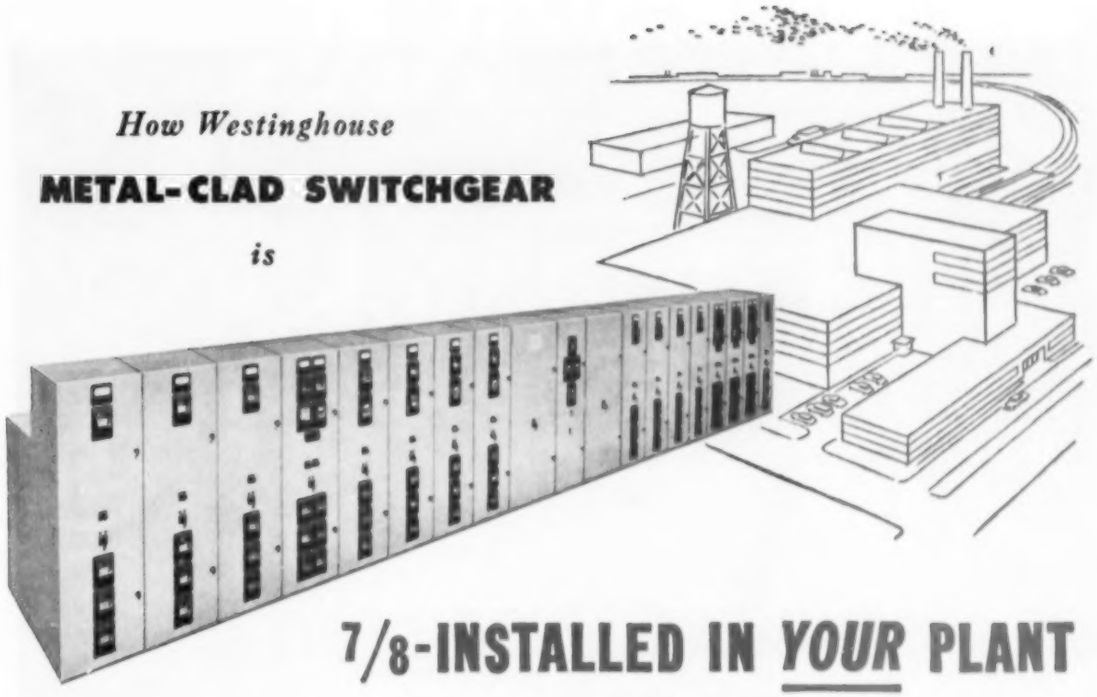
How Westinghouse

METAL-CLAD SWITCHGEAR

is



7/8-INSTALLED IN *YOUR* PLANT

at *OUR* Factory

The only on-site installation work required when your Westinghouse Heavy-Duty Metal-Clad Switchgear arrives at your plant is mounting the units on foundations and connecting main and control circuits. All other "installation" normally associated with switchgear—the assembling, internal wiring and service-testing—is done at our factory, resulting in appreciable savings for you.

Because Westinghouse Metal-Clad Switchgear is *standardized* switchgear—efficiently designed to meet all general industrial and electric utility requirements—you gain many other money-saving advantages. Planning and ordering costs are lower. Operation is simpler because all component parts are safely and conveniently accessible, and disconnects are combined physically with breaker elements. Maintenance time is reduced to a minimum. And you get more circuits in less space.

But these are only *some* of the reasons why Westinghouse Standardized Switchgear will fit *your* needs more economically. To get the whole story, write to me today, on your company letterhead, for a free copy of booklet BW-5306A.

J. H. Smith, *Supervisor*
Switchgear Section

YOU CAN BE SURE
...IF IT'S

Westinghouse

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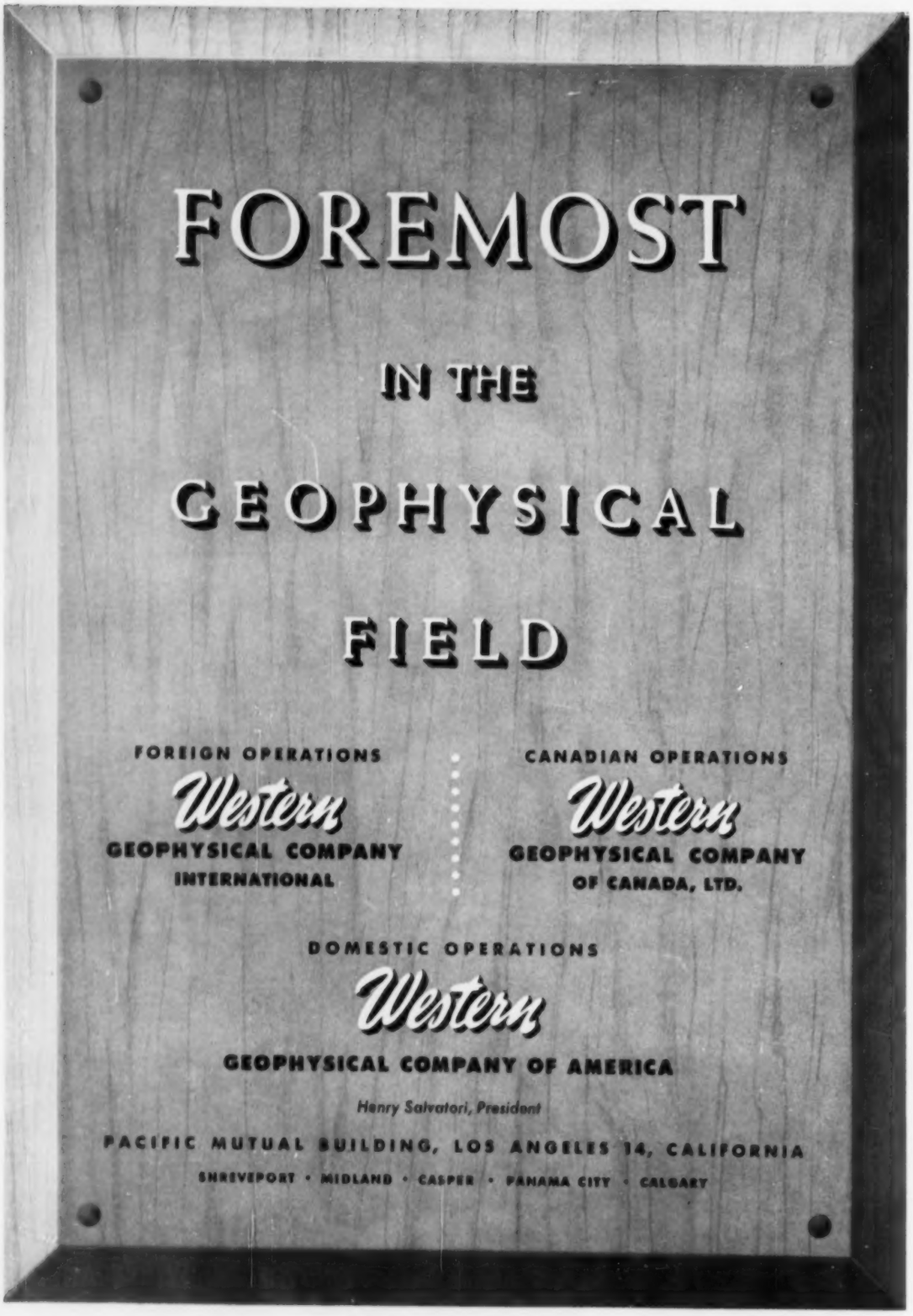
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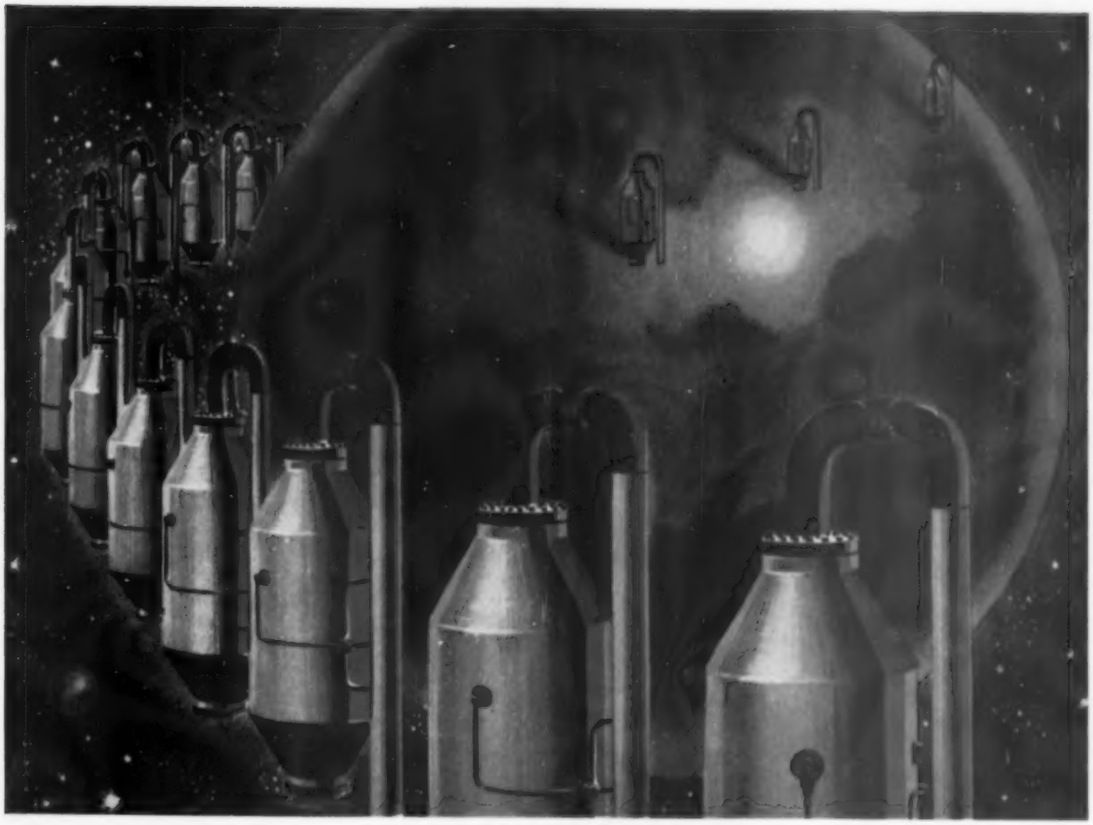


Now...Thanks to Catforming...

HIGH OCTANES, HIGH YIELDS AT LOW COST!

Today, well into its third year of commercial operation, Atlantic's Catalytic Reforming Process is proving its ability to give superior results on a broad variety of feed stocks.

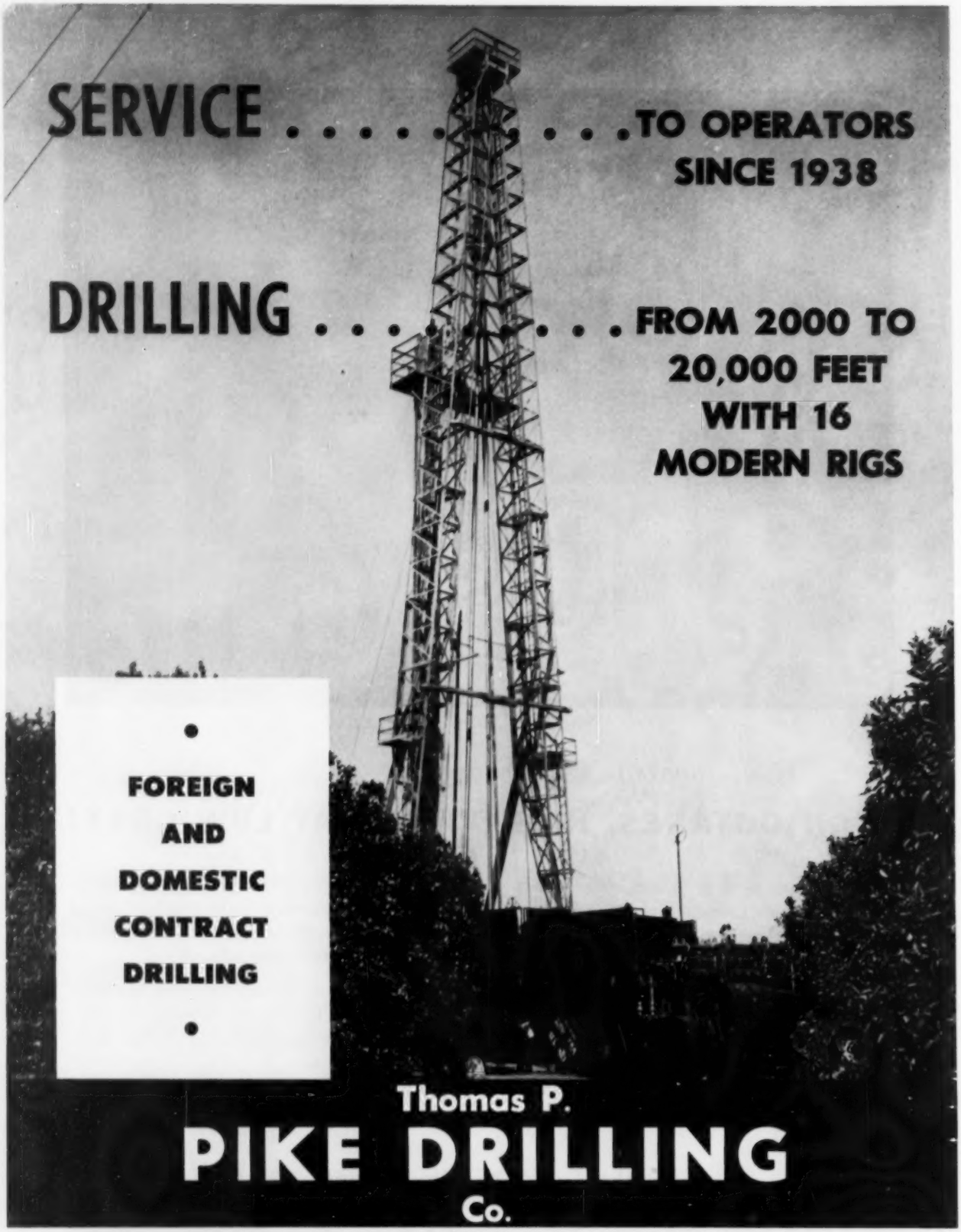
Catforming's simplicity brings savings through increased efficiency every step of the way—actually cutting out many intermediate steps.

Regardless of the size of your operation or the nature of your charge stock, Catforming merits your attention. One reason Catforming has "proved out" commercially is Atlantic's broad experience in all phases of petroleum refining.

Phone or write for our detailed brochure, "CATFORMING." The Atlantic Refining Company, Research and Development Dept., P. O. Box 8138, Philadelphia 1, Pa.

it's the CATALYST that counts

ATLANTIC



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REED *Super Shrink-Grip*
HAND APPLIED TOOL JOINTS

Cut Costs 6 Ways

1. **You save** if a tool joint is damaged by careless handling. You simply replace the damaged joint—*right at the rig.*

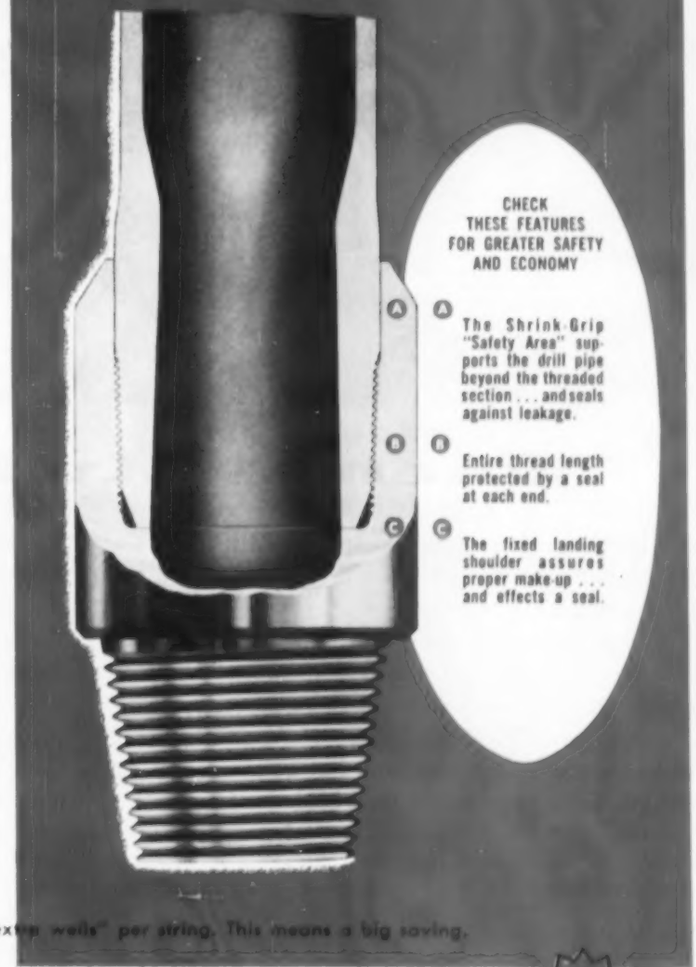
2. **You save** when drill pipe is bent or crushed. You simply buy new drill pipe and transfer your Super Shrink-Grip Tool Joints to the pipe at the rig.

3. **You save** if tool joints wear out when pipe is still usable. By replacing Reed Super Shrink-Grip Tool Joints *at the rig,* you save the transportation costs for tool joint replacement.

4. **You save,** when replacing tool joints, if you reverse ends of the pipe to distribute the wear from slips gripping the pipe. This practice, made feasible with hand replaceable Reed Super Shrink-Grip Tool Joints, at the rig or anywhere, greatly increases drill pipe life.

5. **You save** because Reed Tool Joint threads receive a special treatment at the factory resulting in a thread surface of soft, smooth phosphates that prevent galling.

6. **And you save** because with the Reed Super Shrink-Grip Tool Joint you are using the safest tool joint made. More than a million such tool joints giving trouble-free service prove beyond doubt that the Super Shrink-Grip eliminates last-engaged-thread failures and washouts.


CHECK
THESE FEATURES
FOR GREATER SAFETY
AND ECONOMY
A
The Shrink-Grip "Safety Area" supports the drill pipe beyond the threaded section . . . and seals against leakage.
B
Entire thread length protected by a seal at each end.
C
The fixed landing shoulder assures proper make-up . . . and effects a seal.

Reed quality tool joints give you those "extra wells" per string. This means a big saving.

Write for complete information.

REED ROLLER BIT COMPANY
HOUSTON 1, TEXAS
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whence Kwinana?

June, 1921 . . . deep winter in southern latitudes. The freighter *Kwinana* was driven by an unprecedented gale on to the beach in Cockburn Sound.

Thirty-one years after the disaster, the bush gave way before machines, and a refinery started taking shape. By 1956 the new enterprise will be treating 3,000,000 tons of petroleum products a year. Lofty steel columns overshadow the rusted iron hulk on the shore; but the old ship's name rings round the world.

Kwinana Refinery was designed by the M.W. Kellogg Company and their British subsidiary, the Kellogg International Corporation, for Australasian Petroleum Refinery Limited, an associate of the British Petroleum Co. Ltd. Actual construction of the £A40,000,000 project was entrusted to a consortium of three British contractors known as the Kwinana Construction Group. One member of the consortium is D. & C. and William Press Limited.

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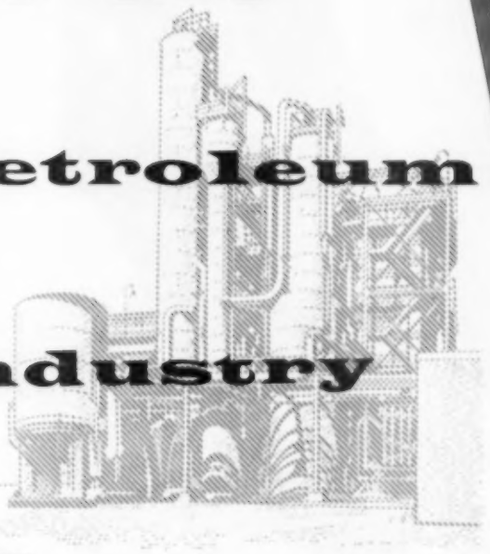
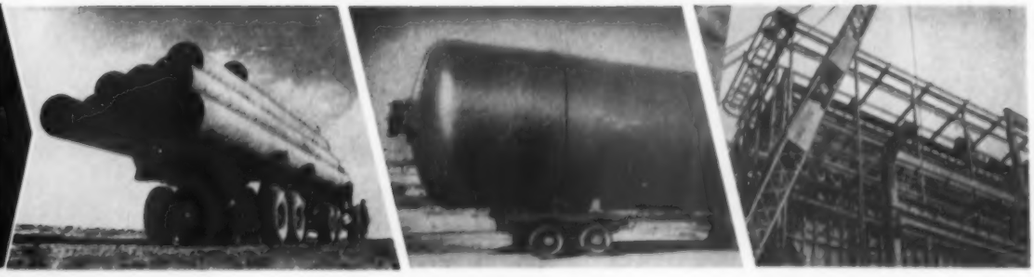
Steel Products for the Petroleum Industry by



SOUTH DURHAM



PIPES

In addition to steel pipes of ordinary Commercial quality South Durham manufacture pipes welded inside and outside by the submerged arc process to meet the special requirements of the petroleum industry in diameters of 16 inches and up to A.P.I. Specifications 5L and 5LX.

TANKS & PRESSURE VESSELS

All problems of liquid storage are met by the Company's facilities for tank and pressure vessel construction. Welded and mild steel tanks are fabricated to Class I and Class II requirements and the Company is on Lloyd's List for recognised welding standards.

STRUCTURAL STEELWORK

The Company's constructional department undertakes the design, fabrication and erection of structural steelwork for all types of general industrial structures and petroleum installations.

SOUTH DURHAM STEEL & IRON CO. LTD. (INCORPORATING CARGO FLEET IRON CO., LTD.)

MALLEABLE WORKS, STOCKTON-ON-TEES, ENGLAND. Phone: Stockton-on-Tees 66117. Grams: "Malleable," Stockton-on-Tees.

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There's not enough food for you and the bugs

As any backyard gardener knows, you have a fight on your hands from the moment you turn over your first spadeful of earth. At every step, fungus growths, weeds, and insects that chew, insects that suck are waiting to destroy your lawns, trees, plants, flowers. It is a disheartening struggle for Greenthumbers . . . a round-the-clock fight for commercial farmers.

Fortunately, there's a growing list of weapons we now can wield in the battle against bugs. Some of the most effective have been developed in the laboratories of California Spray-Chemical Corporation, a Standard Oil Company of California subsidiary. In 1907, we brought out the first basic lead arsenate to stop the codling moth, a rampaging fruit crop destroyer; later, the invention of new-type summer and dormant oil sprays safely checked scale and other insects.

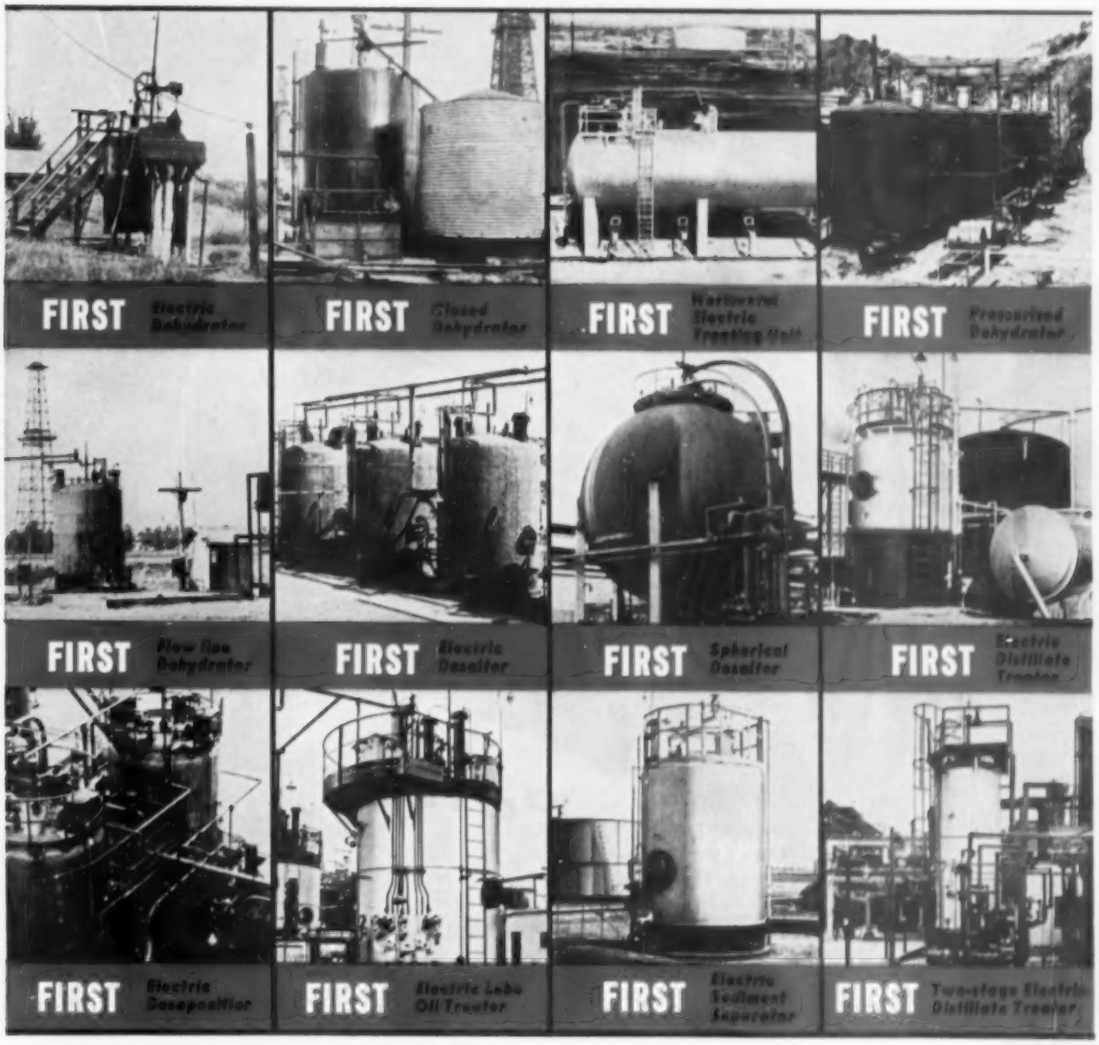
Other Standard research achievements have been chemicals to kill aphis, mites, thrips, and similar sucking insects . . . dusts to destroy fungus diseases like rust, blight, mildew...sprays and dusts custom-made to knock out such public enemies as the devastating grasshopper, boll weevil, hornworm. Other pest-killers boost milk production from our dairy herds, help beef cattle fatten faster.

One good reason you live in the world's best-fed nation is because insect invaders have been held back on our farms, ranches, and orchards, thanks in part to Standard's constant hunt for new ways to make petroleum do more things for you.

STANDARD OIL COMPANY OF CALIFORNIA *plans ahead to serve you better*

LEADERSHIP

Petreco leadership in electric processing is based on a long series of "firsts"



This foundation of progressive pioneering has enabled Petreco to help various branches of the industry increase both efficiency and profits. When emulsification threatened to cause the waste of millions of barrels of "cut" oil, Petreco brought out the first electric dehydrator. When salt was first recognized as an enemy in refining, Petreco developed the first electric desalter. When sediment in certain crude oils shortened the life of sub-surface pumping equipment, Petreco developed the electric sediment separator. As refinery processing became more precise, Petreco provided electric distillate treating to insure precision-controlled contacting, scrubbing and washing.

There is one basic and important reason why Petreco has been able to carry on this continuing program of pioneering development — the users of Petreco processing have profited substantially from this use.

For complete information on any of the Petreco electric processes, write or call

PETRECO

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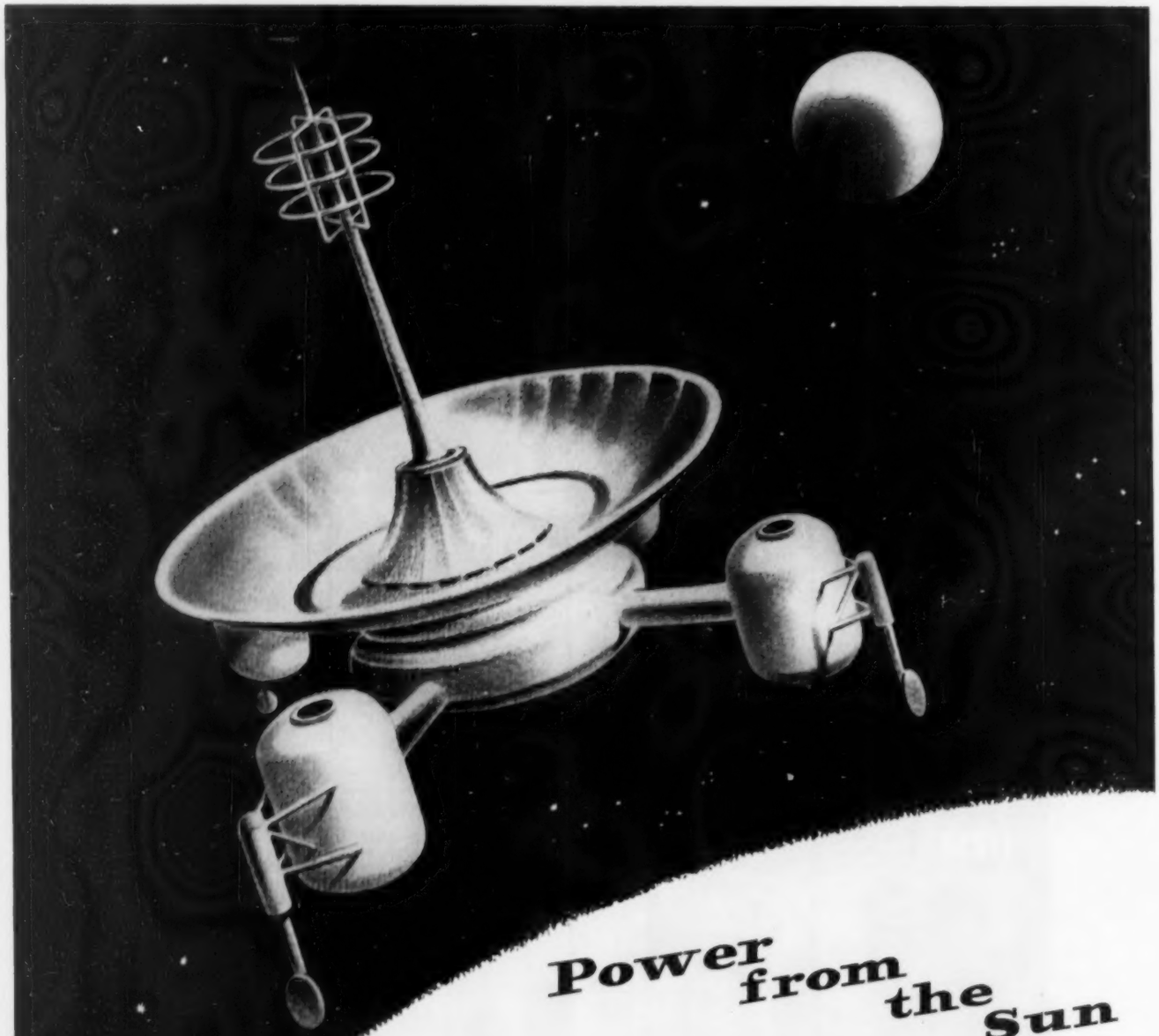

Power from the Sun

Our first space station to circle the earth a thousand miles up, will almost certainly obtain power from the sun's rays, caught by a huge reflector. This solar heat would drive the turbines for the generation of electricity to provide the station's initial power, air pressure and heating to enable the occupants to live in normal conditions.

The satellite itself once reaching the required speed would revolve round the earth forever, without further power.

In the meantime, however, coal and oil are still our greatest source of power and Kenyon Planned Heat Insulation the greatest aid to their economical use.

Kenyon *Planned* **HEAT INSULATION**

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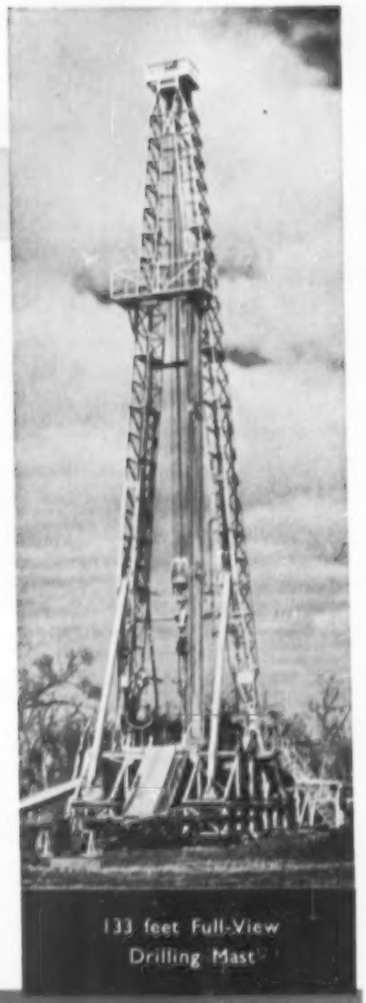
IDECO
WOODFIELD

Makers of drilling and production equipment in association under licence with IDECO division of Dresser Equipment Company, U.S.A.

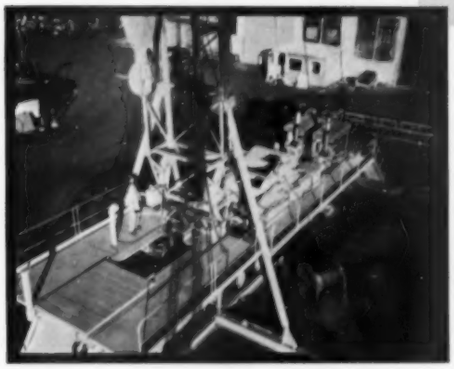
Drive-in Rambler Rig for servicing, workover and light drilling

W4A Servicing Rig for operating with or without Mobile Mast

H-20 Rig with KM-65-100-C Mast

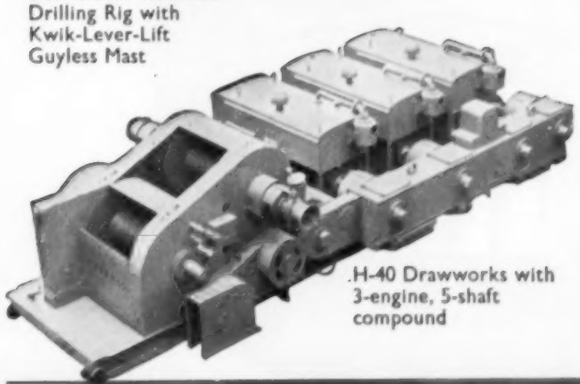


133 feet Full-View Drilling Mast



Dual trailer mounted Drilling Rig with Kwik-Lever-Lift Guyless Mast

W7 Mk II Servicing Rig on Scammel 6 x 6 "Constructor" Vehicle jointed to leave mast at location



H-40 Drawworks with 3-engine, 5-shaft compound

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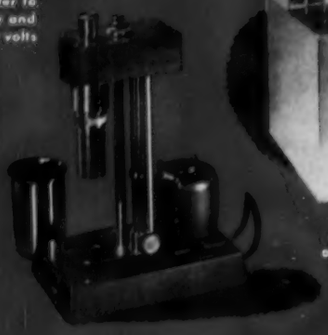
Fann V-G-Meter to test viscosity and gels; 6 or 110 volts



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PETROLEUM CHEMICALS DIVISION
NEWS

June ★ One of a Series of Interest to the Petroleum Industry ★ 1955

New TEL Plant to be built by Du Pont in California

A new convenience will soon be realized by West Coast refiners when the planned Du Pont tetraethyl lead manufacturing plant near Antioch, California is completed.

The rapidly growing TEL requirements of the West Coast petroleum industry prompted the Du Pont Company's decision to build the plant in the California location. The site is approximately two miles east of Antioch on the San Joaquin River. It is readily accessible to both water and rail transportation.

Construction of the new plant is expected to get under way this summer. In addition to the TEL manufacturing facilities, a "Freon" refrigerants plant will also be constructed on the same site.

9 out of 10 WANT it

. . . and your dealers can profit by offering it

Oil check is the most important dealer service, say 90% of the motorists interviewed in a survey of consumer service station buying habits.

But does a check of the dip stick really sell oil? Actual service station observations show that almost half of the motorists who receive it buy oil as a result of the check. Yet customers are offered an oil check on only 36% of their service station stops.

This means that your dealers can increase their motor oil sales simply by offering to check the dip stick for *every* customer. To help you emphasize this profitable point to your dealers, we have prepared a new booklet (No. 4) in the "Looking through the windshield" series. The title is, "A look at the motor oil buyer."

Ask one of our representatives for sample copies and cost information on obtaining them in quantity.

You can profitably expand your diesel fuel market with Du Pont FOA-2

In addition to their growing demands for more diesel fuel, the railroads are endeavoring to reduce operating costs. In order to meet these demands and maintain your profit margin, you may be faced with the problem of producing diesel fuel at lower cost.

That's a tough problem, to be sure. But it *can* be solved. And here's how Du Pont Fuel Oil Additive No. 2 can help you solve it, *profitably*.

You simply use Du Pont FOA-2 to stabilize your cracked distillate stocks. Its double-action stabilizing and dispersant effect enables you to overcome the incompatibility between blends of cracked and straight-run stocks.

And this means added production flexibility for you . . . helps you keep your heating oil stocks in better balance to meet varying seasonal demands.

Proven results

Many leading railroads are now using No. 2 fuel oils containing Du Pont FOA-2. And they have reported excellent results.

They have proved through careful testing that they can efficiently operate diesel engines on cracked distillates stabilized with Du Pont FOA-2 without harmful effects.

Good filterability

Because of its excellent dispersant action, FOA-2 improves the filterability of diesel fuels. In this way it helps to eliminate most injector-sticking and filter-plugging problems.

Non-sparking

Being an *organic, non-metallic* additive, Du Pont FOA-2 does not contribute to the exhaust stack sparking problem.

OVER

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PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED

Diesel Fuel Additive

Economical

Du Pont FOA-2 is extremely economical to use because it is effective in low concentrations. And you need no special equipment for adding it.

Test it yourself

Your fuel laboratory can easily test the effectiveness of FOA-2 in your own fuel oil stocks.

Free samples and complete technical information are readily available. Any Du Pont Petroleum Chemicals Division representative or regional office will be glad to supply them.

PHILADELPHIA DISTRICT MANAGER

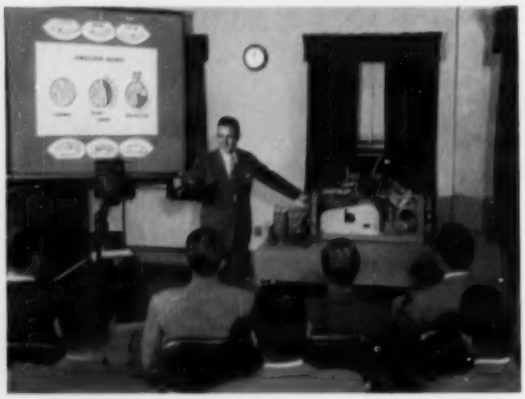
LEWIS Z. CAREY is manager of the Du Pont Petroleum Chemicals Division's Philadelphia District, which serves the Delaware Valley area and the states of Maryland, Virginia, and North Carolina.

A graduate of the University of Delaware, he joined the Du Pont Company in 1941. He was a salesman in the Alcohol Division until 1950 when he was transferred to the Petroleum Chemicals Division as a sales-service representative.

Mr. Carey is vice-chairman of O.I.I.C. in New Castle County, Delaware and is active in both Delaware and Maryland O.I.I.C. activities.

During World War II, he served with the U. S. Navy.

HIGHLY SENSITIVE DEMONSTRATION ENGINE... to build dealer enthusiasm for your gasoline quality



Engine readings can be projected directly onto a screen for showings to large audiences. Or the unit can be set up on the back platform of a station wagon where the performance can be shown with the direct reading instruments.

Here is a brand new demonstration tool with an amazing talent for persuasion.

Gasoline quality may be one of the hardest things in the world to demonstrate clearly, even to dealers. But this new, single-cylinder engine setup can do it with superb showmanship. And if you want to turn a "doubting Thomas" into a satisfied customer, here's just the tool to do it with.

High compression engine

The unit is built around a single-cylinder engine with a 9.0 to 1 compression ratio. Other compression ratios are also available. With overhead valves and a hemispherical combustion chamber, it follows the latest design features of truly up-to-date automobile engines.

The engine is belted to an alternator and the power developed is dissipated in resistance grids.

Versatile

All types of combustion – normal, detonation and surface ignition – can be readily demonstrated with the unit. It can also be used to clearly demonstrate the wide variety of factors which influence knock – such as temperature, humidity, barometric pressure, spark timing, carburetor setting, etc.

Even wild ping and the various factors influencing surface ignition can be realistically shown.

Extremely sensitive, this engine will show up very slight differences in octane rating. And it is flexible enough to be adapted for tailor-made demonstrations to point up your own individual gasoline quality features.

Available soon

A number of these single-cylinder engine units are now being made and will soon be available to you on loan through any of our regional offices.

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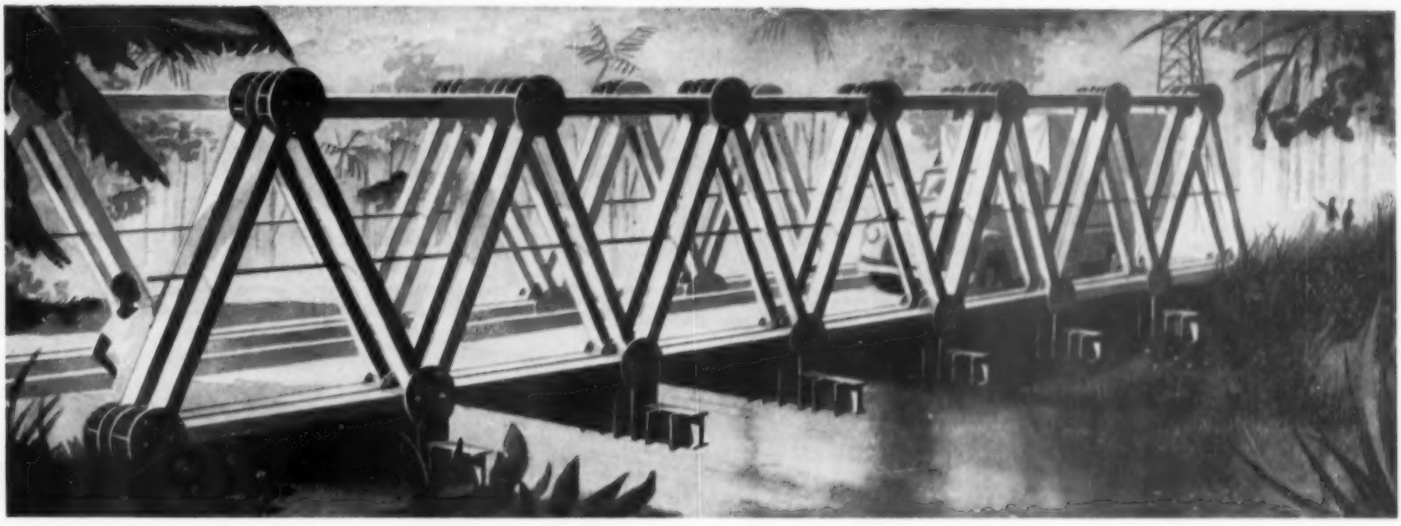

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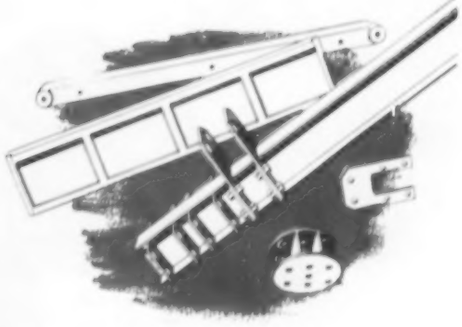
Butterley Standard-Unit Bridges are in use all over the world where transport is difficult, skilled labour scarce or where site preparation has to be carried out under adverse conditions. From five standard units, all sizes of bridges can be built; the units can be sent by any form of transport; site erection is remarkably simple and swift with an absolute minimum of equipment.



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A message for all attending Fourth World Petroleum Congress

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The Dresser Plus + not only personifies added value, it stands for special service the world over. That's why our friends and customers will find Dresser executives on hand to greet them at the Fourth World Petroleum Congress, June 6 to 15, 1955. Dresser is a group of companies under a common ownership, organized to better serve your interests in the oil, gas and chemical fields. Wherever you are, whenever you do business with any Dresser unit, the combined technical knowledge, experience and vast resources of the entire Dresser group is at your command.

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"Dresser Plus +" ajoute et non seulement personnifie une valeur additionnelle mais encore représente un service spécial dans le monde entier. C'est pourquoi nos amis et clients trouveront les dirigeants de "Dresser" prêts à les accueillir au Quatrième Congrès Mondial du Pétrole, du 6 au 15 juin 1955. "Dresser" est un groupe de compagnies sous une direction commune, organisé pour mieux servir vos intérêts dans les domaines du pétrole, de l'essence et les produits chimiques; où que vous soyez, à n'importe quel moment que vous fassiez des affaires avec une branche quelconque de "Dresser," les connaissances techniques, l'expérience et les vastes ressources combinées du groupe "Dresser" tout entier sont à vos ordres.

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At Sui in Pakistan there is abundant natural gas. Away in Karachi there are industries which could use it for fuel. Engineers have contracted to connect the two—by 350 miles of steel pipeline carrying millions of cubic feet of gas per day.

To protect this pipeline from corrosion ten million square feet of Fibreglass tissue pipewrap will be used in field application. The contract for the whole of this pipewrap has been secured by Fibreglass Limited, in open competition.

In fact Fibreglass will be used in more ways than one, for the outer wrap of 'Thermoglas', to be supplied by D. Anderson & Son Ltd., is also based on Fibreglass tissue.

Yet this pipeline is only one of many in all parts of the world which rely on Fibreglass for protection against corrosion — and the protection of pipelines is only one among the many ways in which Fibreglass contributes to the efficiency of modern industry.

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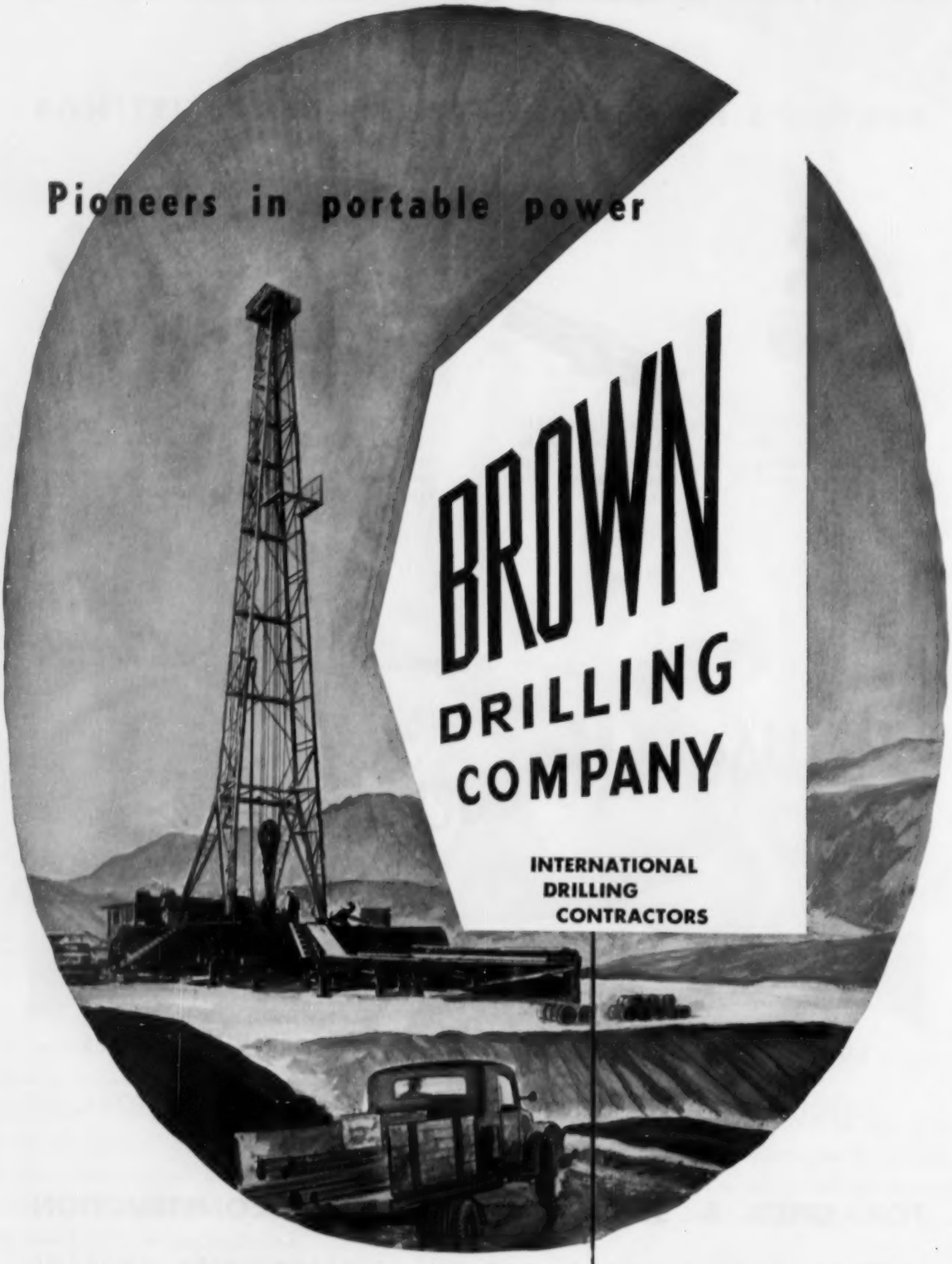

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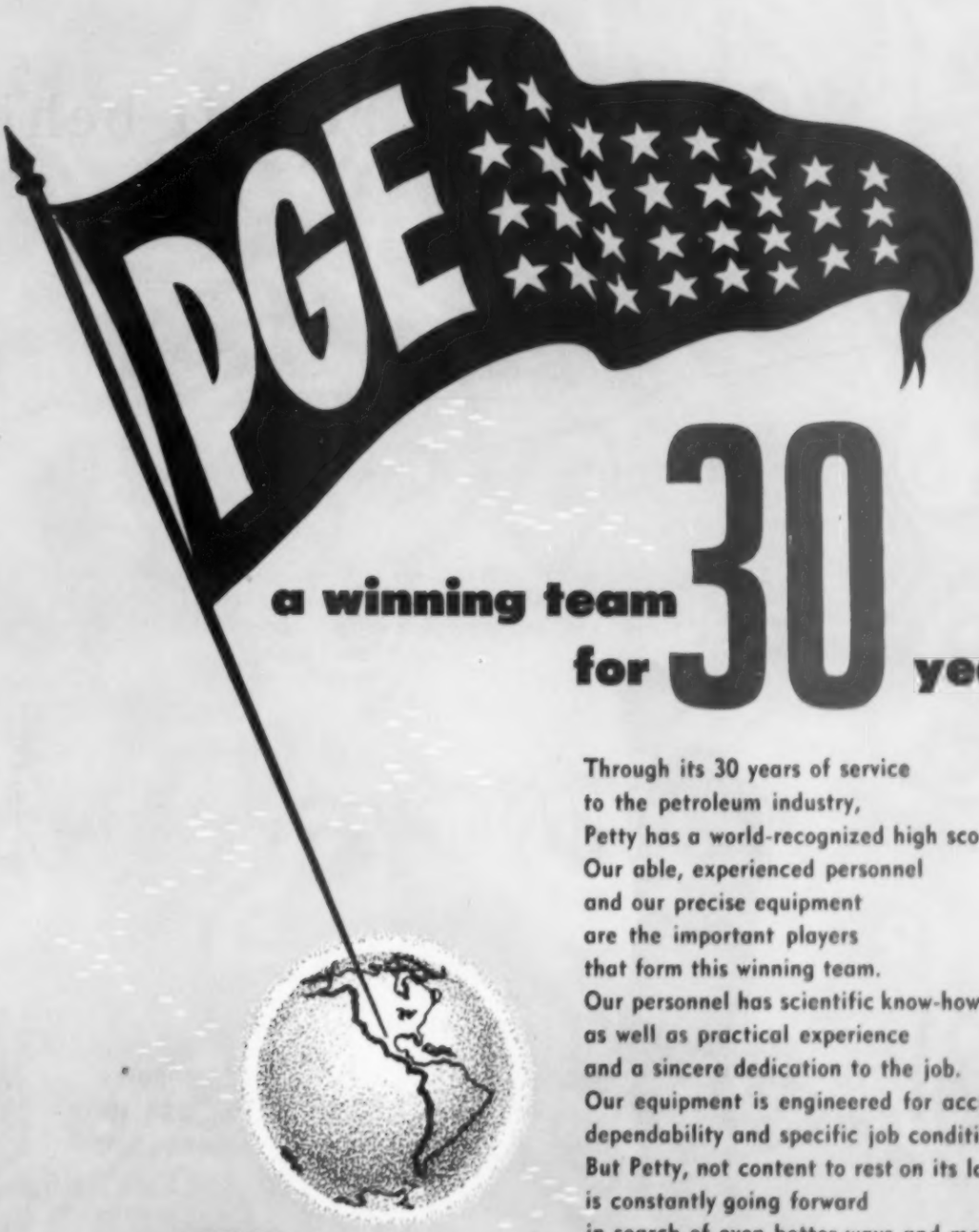

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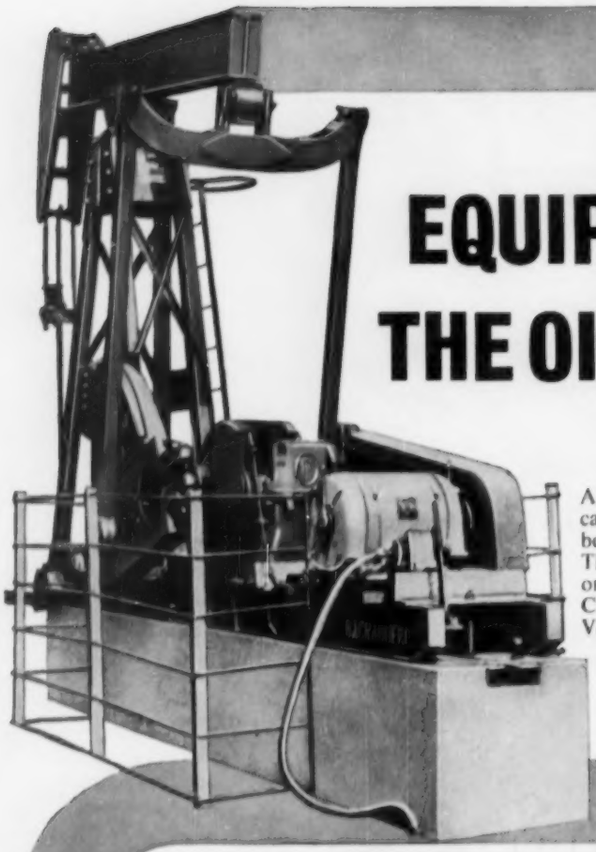
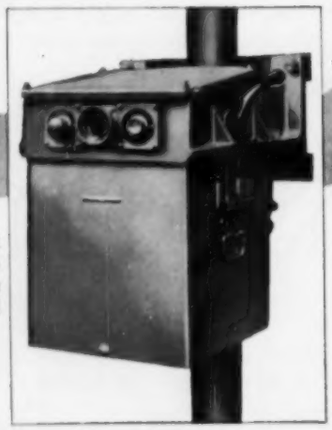
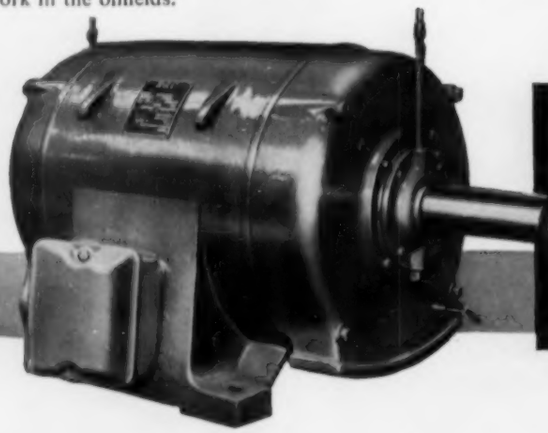


A high torque squirrel cage motor driving a beam type well pump. This installation is on one of the oilfields of Compania Shell de Venezuela.



A combined circuit breaker and contactor starter for the automatic control of oilwell motors.

A G.E.C. weatherproof motor designed and built for arduous work in the oilfields.



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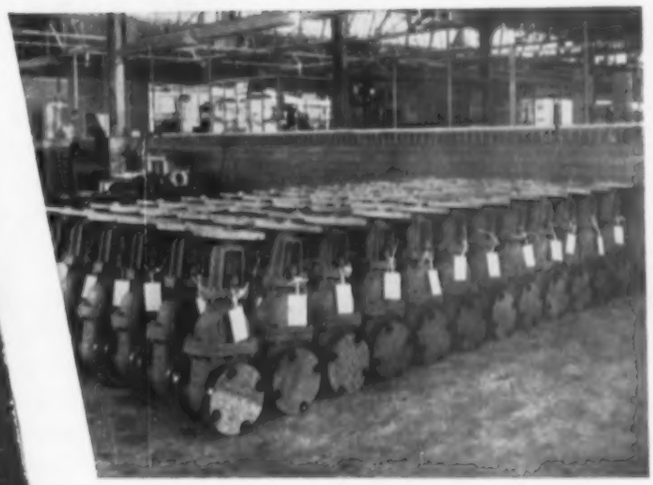

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All this – plus the well-known efficiency and compactness of GM 2-cycle Diesel engines – means faster round trips, easier, lower-cost moves and minimum engine and rig maintenance. For the full story, call your nearest GM plant.

This new Ideco Hydrair H-525 rig and mud pump, with Full View mast, is powered by two GM Diesel "Twin" Six Torque Converter units. Another GM "Twin" drives a stand-by mud pump.

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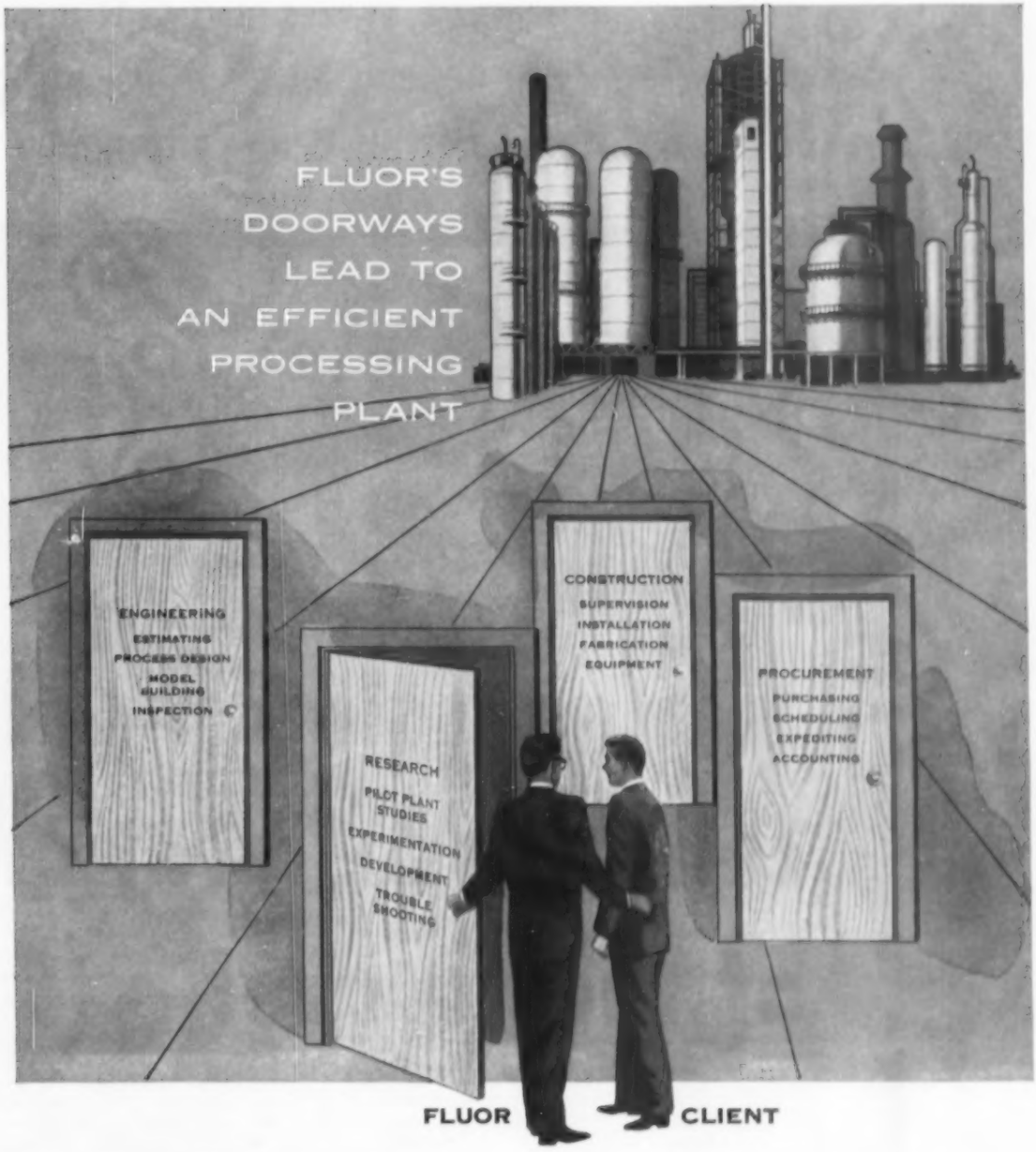

For the petroleum, chemical and petrochemical industries, Fluor employs all skills and possesses the facilities to build a complete, well-equipped process plant from preliminary studies to initial plant operation, or any phase of it. Fluor conducts detailed research for a new or improved process; designs, engineers, procures and fabricates equipment, and constructs the plant in accordance with sound process design specifications. Fluor offers a great variety of services under a single responsibility and writes any type of a contract desired, doing business on *your basis*. Many firms both large and small have profited from Fluor's broad process experience. Let us show you how we can better serve you.

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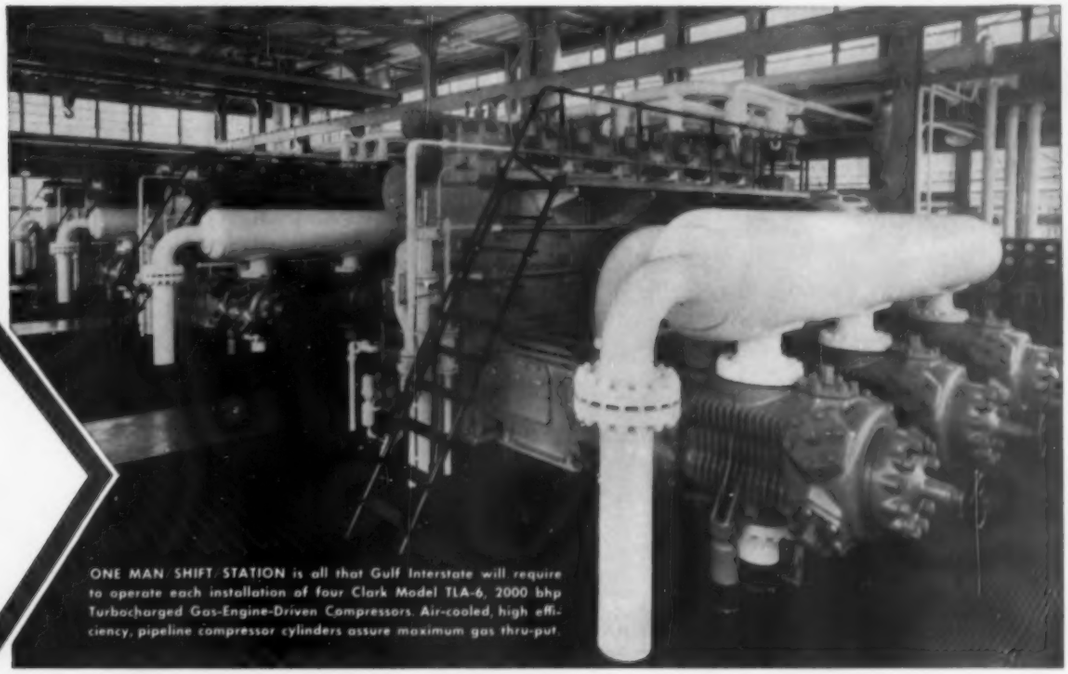
Here's the pattern for gas transmission pipeline compressor stations of the future!

NEW GULF INTERSTATE SYSTEM

Selects the Clark Turbocharged Model TLA-6 for its Automatic, Push-Button Operated Stations



ONE MAN SHIFT STATION is all that Gulf Interstate will require to operate each installation of four Clark Model TLA-6, 2000 bhp Turbocharged Gas-Engine-Driven Compressors. Air-cooled, high efficiency, pipeline compressor cylinders assure maximum gas thru-put.

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If you're interested in a compressor station that can be operated with the highest possible efficiency — *automatically* — while still maintaining station-loading flexibility, be sure you investigate Clark Models TRA and TLA Compressors. There are 8 sizes in a range of 825-3300 bhp. Ask your nearest Clark representative for Bulletins 130 and 134.

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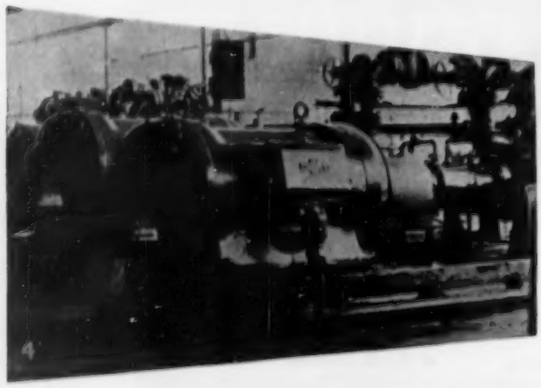
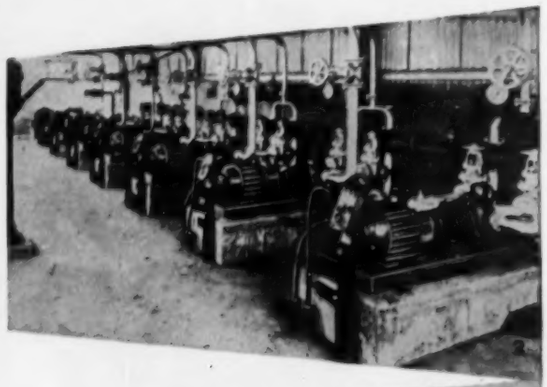
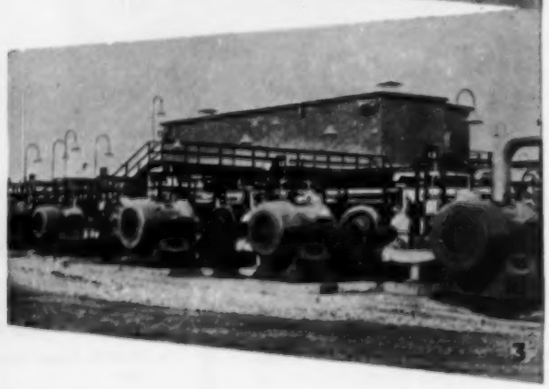
FLAMEPROOF MOTORS

certified for group 2 and group 3 gases

A complete range of Metrovick Buxton-certified flameproof motors is available for refineries and petro-chemical works, for either indoor or outdoor use. Machines with either ball and roller bearings, or sleeve bearings, can be supplied, and all are suitable for hot product pumps.
A specialised range of splash-proof well-pump motors and industrial type machines for non-hazardous locations is also available.







1. A range of flameproof motors in one of the main pumping stations at Scottish Oils, Grangemouth Refinery. 2. Type KFB flameproof motors driving Sigmund pumps at Shell Stanlow Refinery. 3. 300-600 hp outdoor flameproof motors at the product loading station at Esso Refinery, Fawley. 4. 125 hp 3500 rpm T.E.F.C. motors driving oil pumps at Trinidad Leaseholds Pointe-a-Pierre Refinery, British West Indies.

METROPOLITAN-VICKERS
ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER, 17

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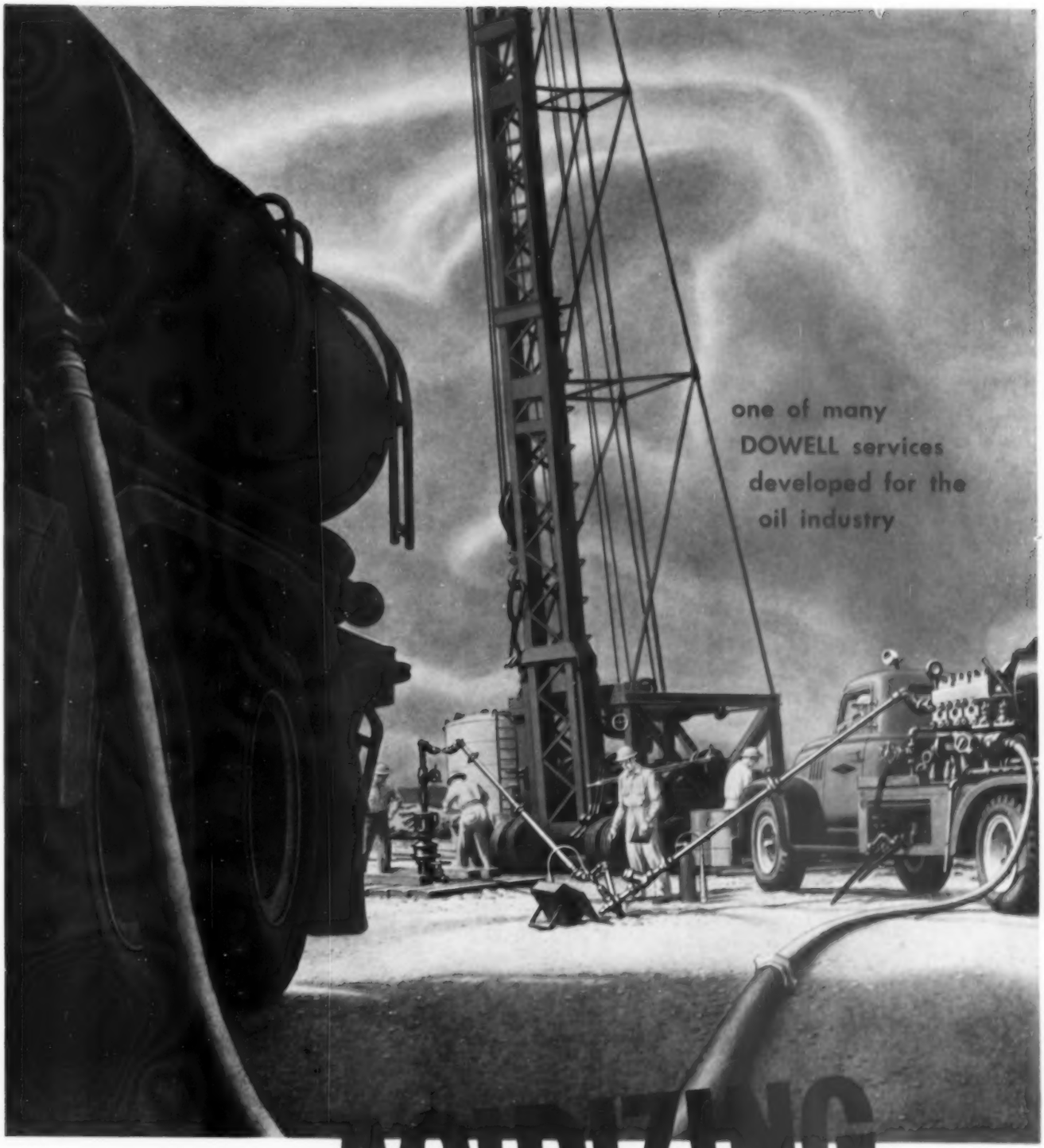

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chemical services for the oil industry

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The Merton Overloader

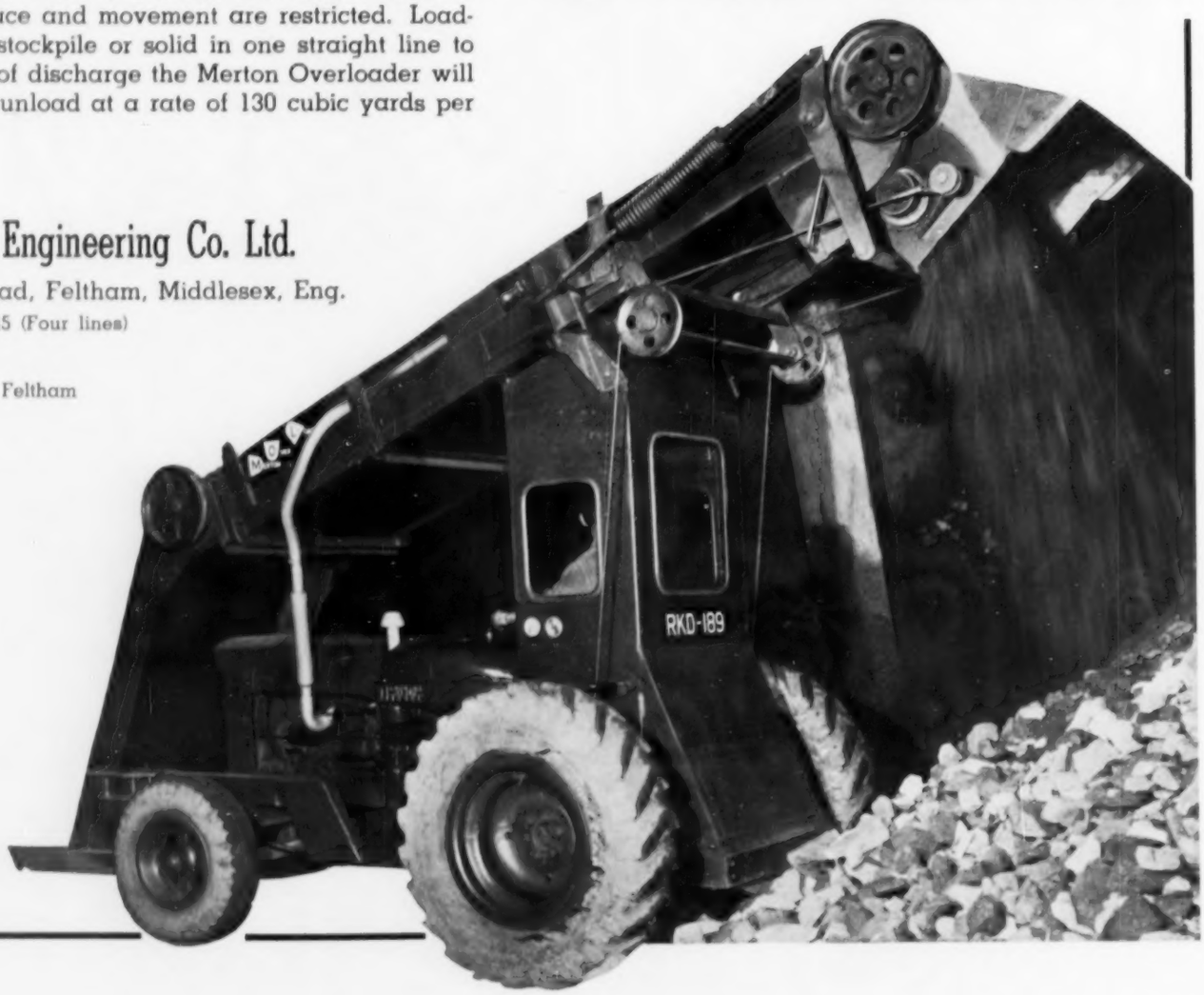
You would hardly expect to find a full size, heavy duty loader in a ship's hold but that is where these photographs were taken. The Swedish motor vessel the S.S. Sarek berthed at Bidston Dock, Liverpool and in just three days her cargo of 8,700 tons of iron ore had been unloaded and she was ready for her next assignment. The Merton Overloader is playing a great part in the effort to speed the turn around of ships not only in Liverpool and London Docks but in installations throughout the world where speed and economy are factors to consider. Adaptability is the secret which coupled to care in design and robust construction make the Merton Overloader a MUST for all those engaged in material handling in bulk. The fastest and most economical loader of its type in the world, the Merton Overloader is at work in 37 overseas territories and is the only machine of its kind made in Great Britain that is being exported to the United States of America.

Unlike the more conventional type of loader which needs room to slew and manoeuvre the Merton Overloader will work in the most confined area where space and movement are restricted. Loading from stockpile or solid in one straight line to the point of discharge the Merton Overloader will load and unload at a rate of 130 cubic yards per hour.

Merton Engineering Co. Ltd.

Faggs Road, Feltham, Middlesex, Eng.
Feltham 3045 (Four lines)

Cables:—
Overloader Feltham



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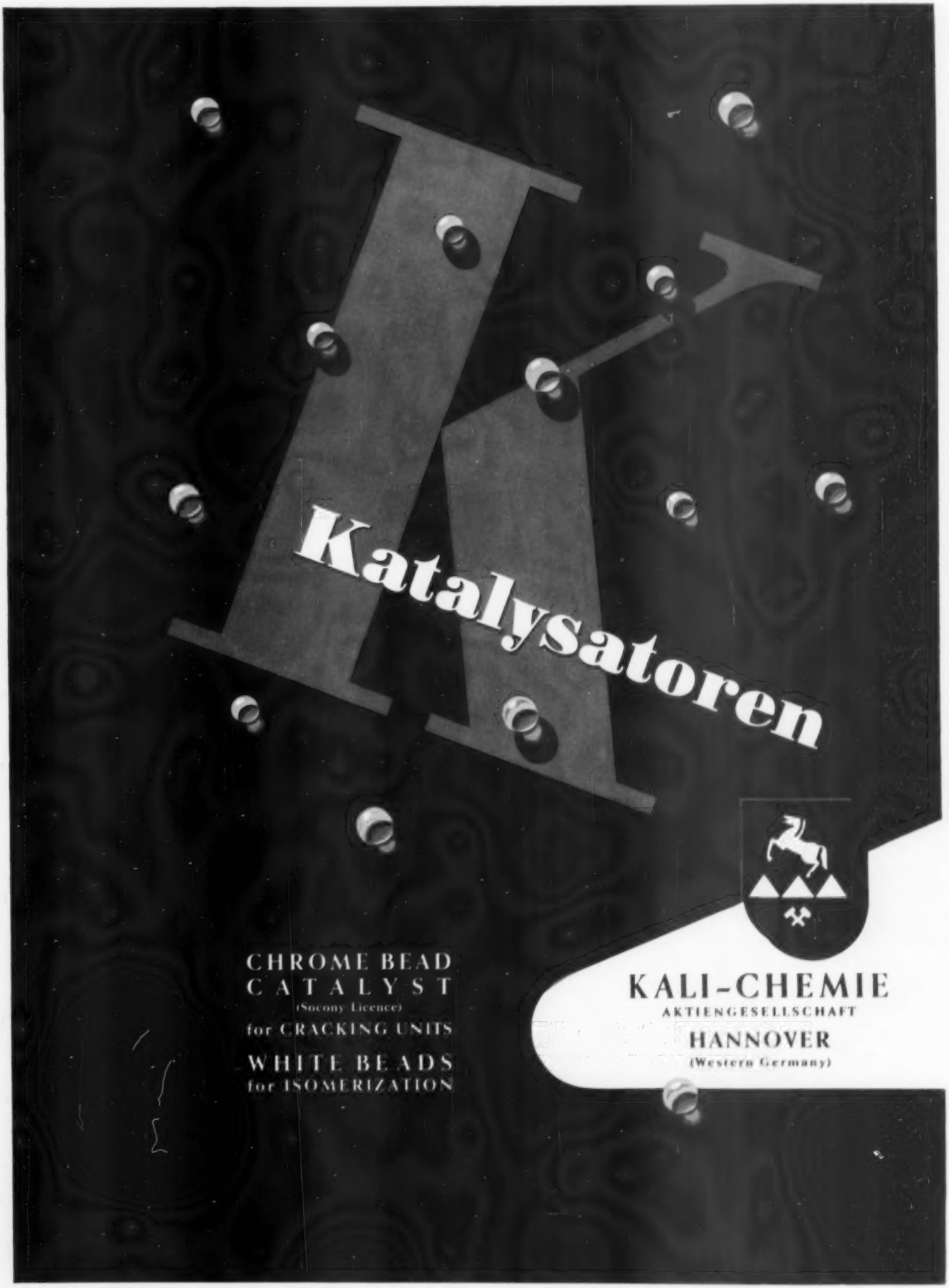
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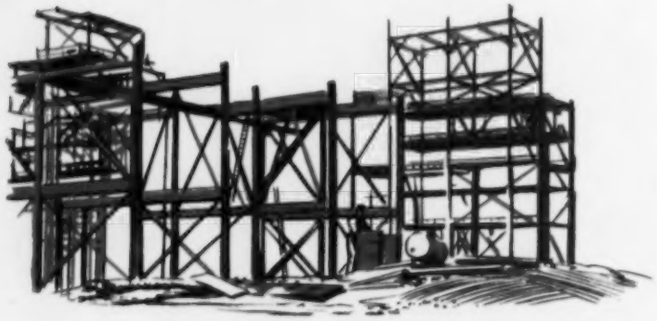
PROTECTION for the OIL INDUSTRY

International is a world-wide paint organisation with expert knowledge of paints for the oil industry. This knowledge is derived from long experience of the industry's special requirements and problems.

INTERNATIONAL RED LEAD GRAPHITE PRIMER

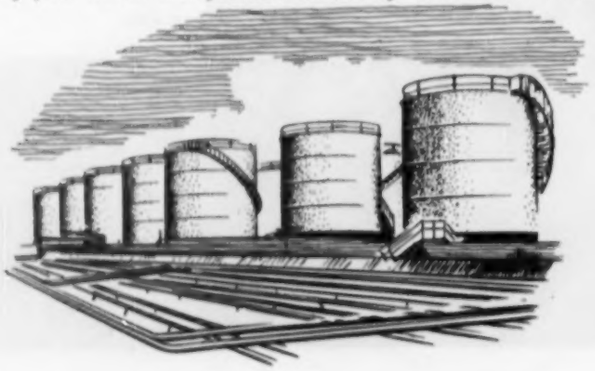
Made from genuine red lead and selected graphite. The leafing effect of the graphite pigment makes this primer dry with an exceptionally strong film of uniform thickness. This means that structural steelwork, storage tanks, gasholders, etc. can be properly painted even by semi-skilled labour.



INTERNATIONAL ALUMINIUM PAINT

Has exceptional leafing properties, forming a firm metal-like protective film. The very high light reflection of this paint makes it ideal for external coatings of storage tanks and pipelines. This aluminium paint does not evaporate in storage, and with International's duplex containers—in which the aluminium paste is kept separate until needed—International Aluminium Paint retains its lustre for a considerable length of time.

If you would like further details of this or other International specialities for the oil industry, please let us know.



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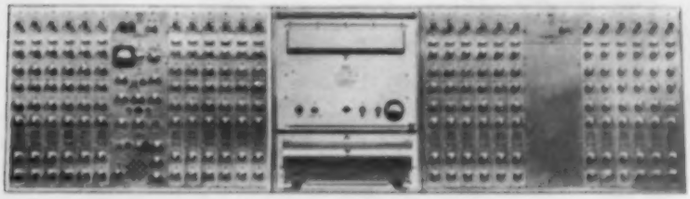
SIE

G-22A

SEISMOGRAPH SYSTEM



for high-production Operations

FREQUENCY RESPONSE: Within 2 db from 10 to 500 cps. Filtering as specified.

LOW DISTORTION: Less than 1% from 10 to 500 cps at 0.1 volt input.

AGC CONTROL RANGE: 0.5 microvolt to 0.1 volt input. (Three time-constants selected from front panel.)

GAIN CONTROL CIRCUITS: AGC, Expander, or simultaneous AGC-Expander operation.

RECORD PRESENTATION: Single record. Dual output. Dual record.

- First-Arrivals Unfiltered.
- Individual Channel Paralleling and Testing Switches.
- Simplified Controls.

Features essential to high-speed operation — available only on special order in many systems — are standard equipment in the G-22A, latest addition to the SIE G Series instruments.

New circuitry provides unmatched performance with all recording methods while simplifying matching and operating procedures.

AGC Time-Constants, mixing method and percentage, and type of record presentation can be selected from the front panel. Two attenuation rates on both high and low cut filters provide hundreds of filtering combinations.

From the new self-biased AGC circuit to the simplified control panel, the G-22A's "field engineered" design combines practical operation with high flexibility.

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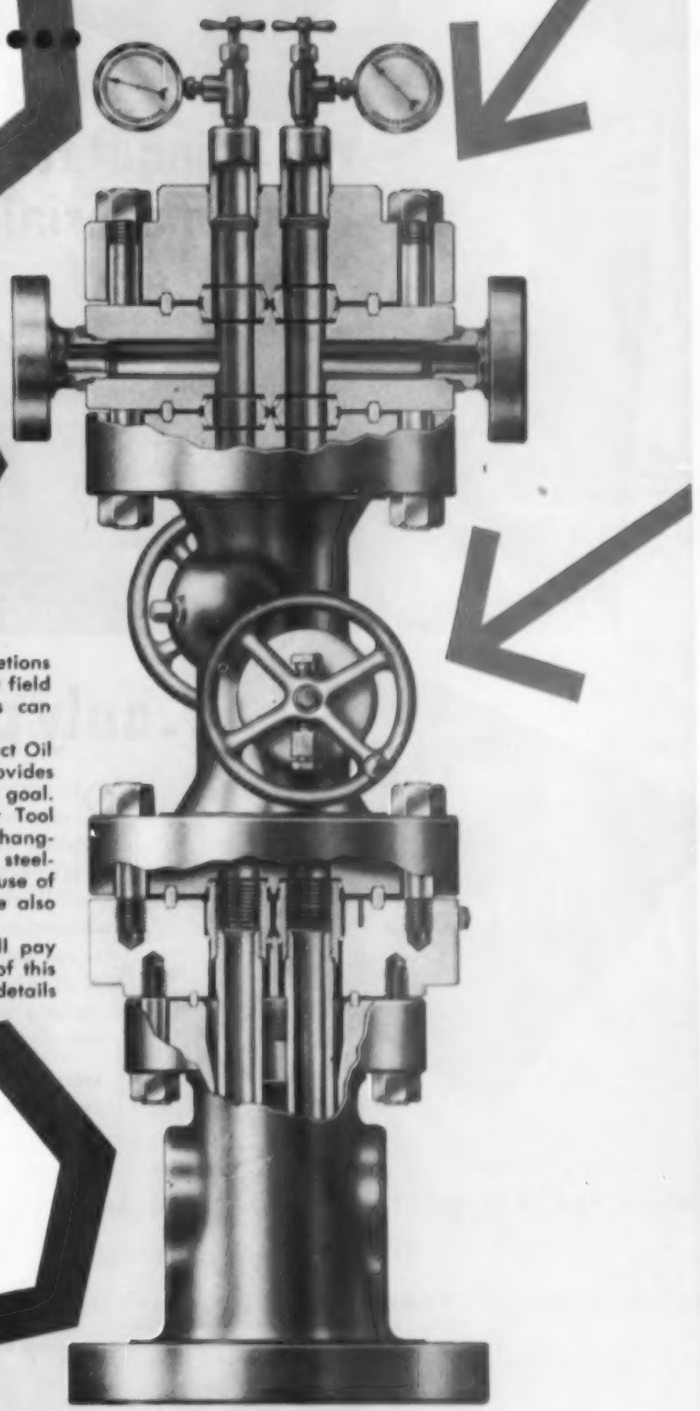

FROM AN ECONOMIC STANDPOINT, dual completions provide the industry with substantial savings in any field where conditions are such that dual completions can be accomplished.

FROM AN EQUIPMENT STANDPOINT, this compact Oil Center Tool Company Christmas Tree assembly provides a safe, strong and practical means to the economic goal.

In developing this dual assembly, Oil Center Tool Company presents these new features: 1. a special hanging and sealing flange on top of the tubing head; 2. steel-to-steel seals throughout the assembly through the use of Flex-Float steel rings. Standard API ring joints are also used as a seal from the atmosphere.

If you are considering dual completions, it will pay you to check these features and get the full story of this new O-C-T Dual Completion Assembly. Write for details or ask your nearest O-C-T Representative.

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OIL CENTER TOOL CO.

P. O. Box 3091, Houston, Texas

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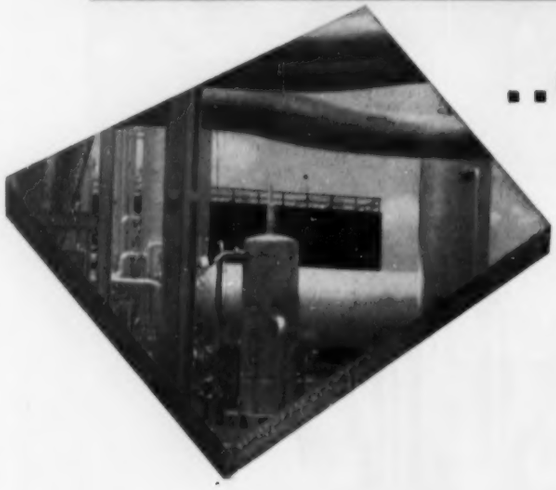
Dual Completion equipment was pioneered and introduced FIRST by O-C-T as early as 1941



..only part of the picture

OIL REFINERY ENGINEERS know that Newalls bring more than materials to the site, because they realise that even first class insulation materials cannot do justice to themselves unless they are efficiently applied. In fact, the task of planning that the right materials are used is a job studied carefully by Newalls before their recommendations are submitted. Through consultation with Newalls you can make very certain that method as well as materials is brought to bear on the problem. That's maybe why Newalls record of refinery insulation jobs makes such an impressive picture.

RECENT CONTRACTS **Among the large petroleum projects to which Newalls have supplied insulation materials recently are the Anglo Iranian Oil Company's new refineries at Aden and Kwinana and also the new Brazilian State Refinery at Cubatao, Brazil.**

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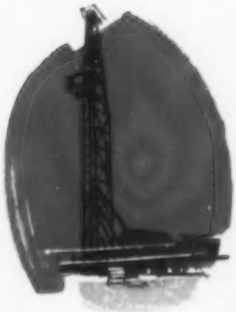
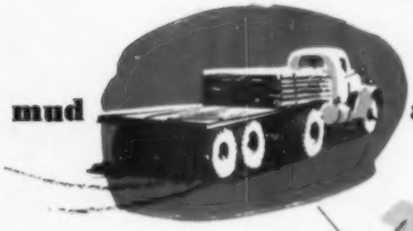
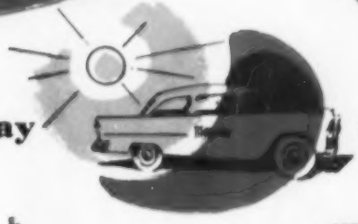


mud



alone . . .

it means day



and night

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mud engineering service.

It's a twenty-four hour, day and night job to give the kind of service the oil industry needs. And Magcobar mud engineers and dealers alike gladly accept this requirement for good service. Ever since Magcobar entered the drilling mud picture, field mud engineering service has been constantly improved and expanded. In fact, Magcobar alone today has more mud engineers in the field than the total of all mud companies just a decade ago. When you need service at your well, call the dealer who stocks Magcobar. You'll get the best mud service in the oil fields.

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Complete
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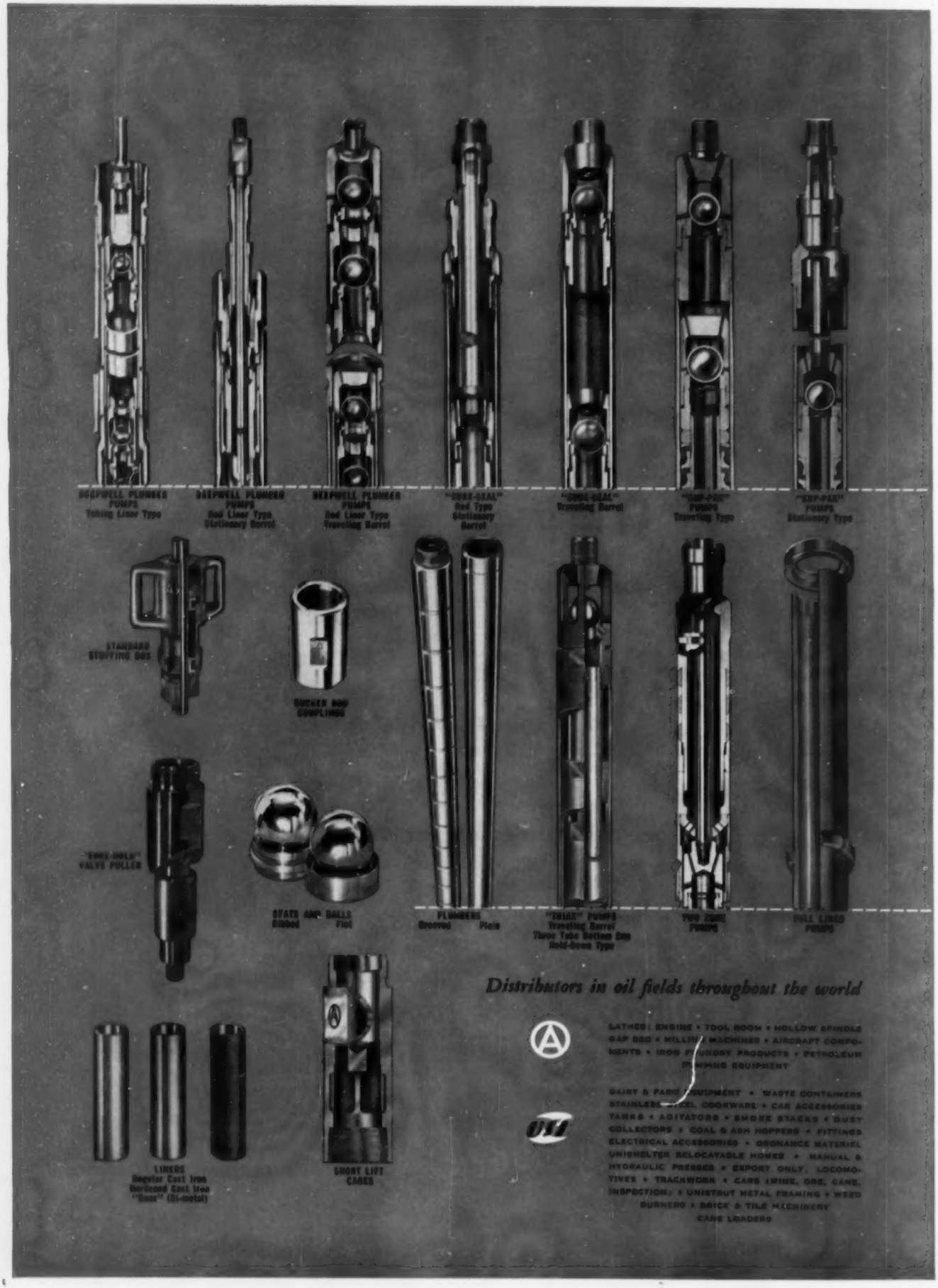
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DEEPWELL PLUNGER PUMPS
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Stationary Barrel
DEEPWELL PLUNGER PUMPS
Rod Liner Type
Traveling Barrel
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Rod Type
Stationary Barrel
"CHRE-SEAL"
Traveling Barrel
"SLIP-FAST"
PUMPS
Traveling Type
"SLIP-FAST"
PUMPS
Stationary Type
STANDARD
STUFFING BOX
SUCKER ROD
COUPLINGS
"SHEA-HOLD"
VALVE PULLER
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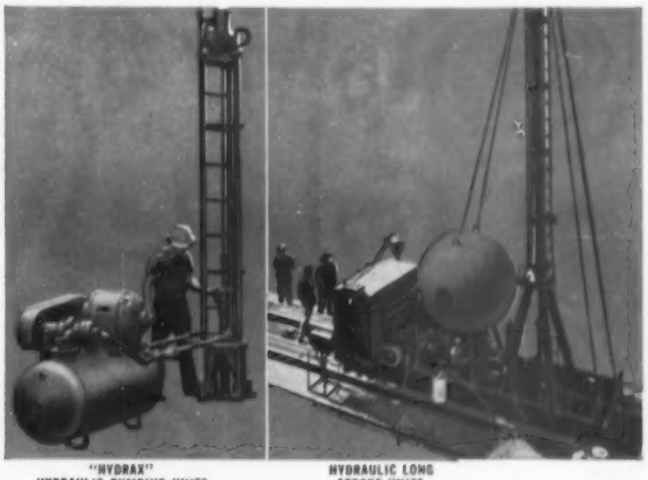

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HYDRAULIC LONG STROKE UNITS

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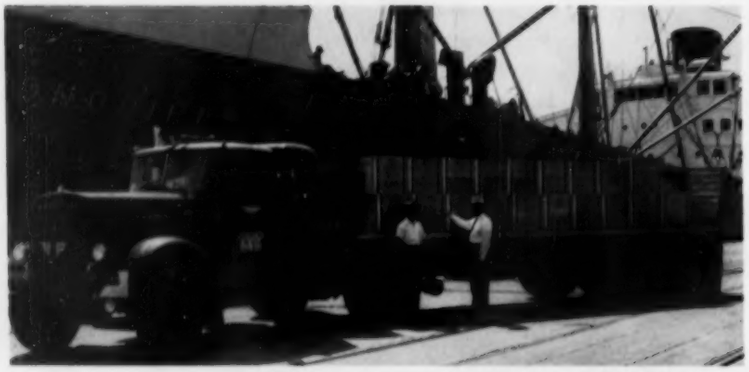

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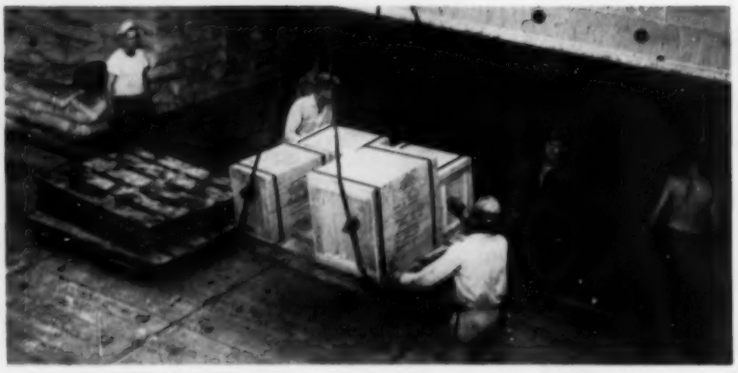

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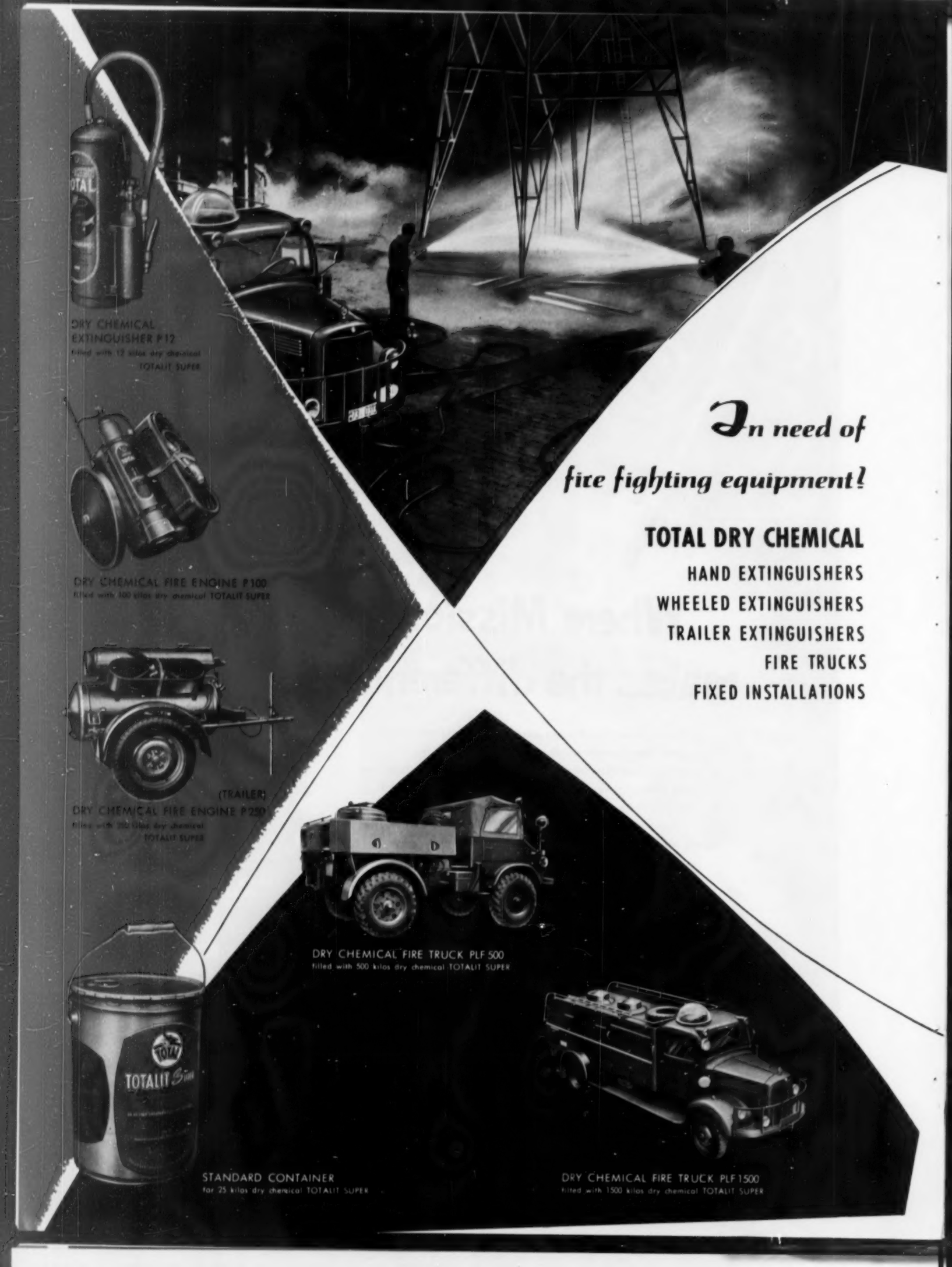
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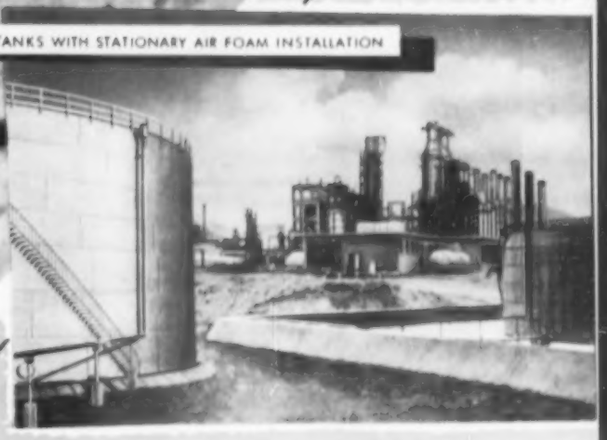
REFINERY AND TANKS WITH STATIONARY AIR FOAM INSTALLATION



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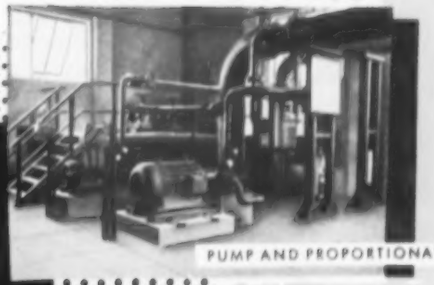
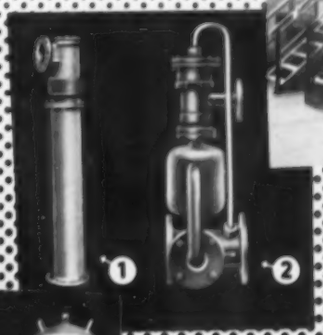
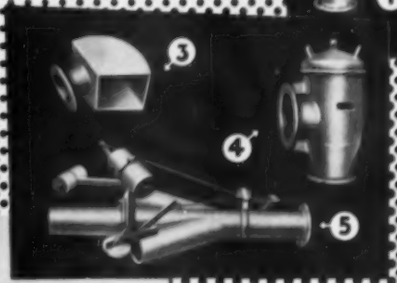


PUMP AND PROPORTIONATOR STATION





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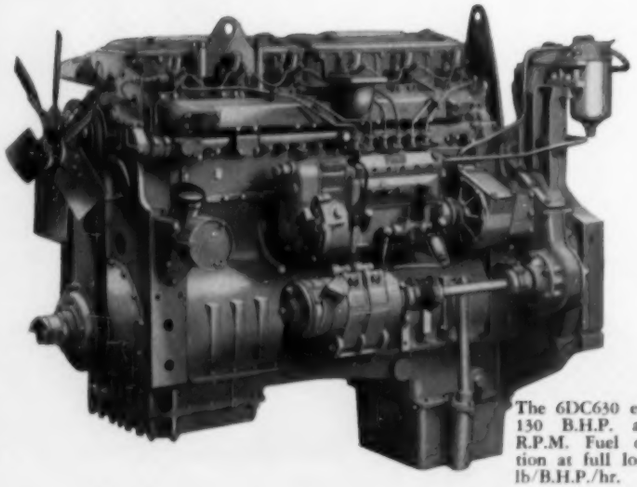

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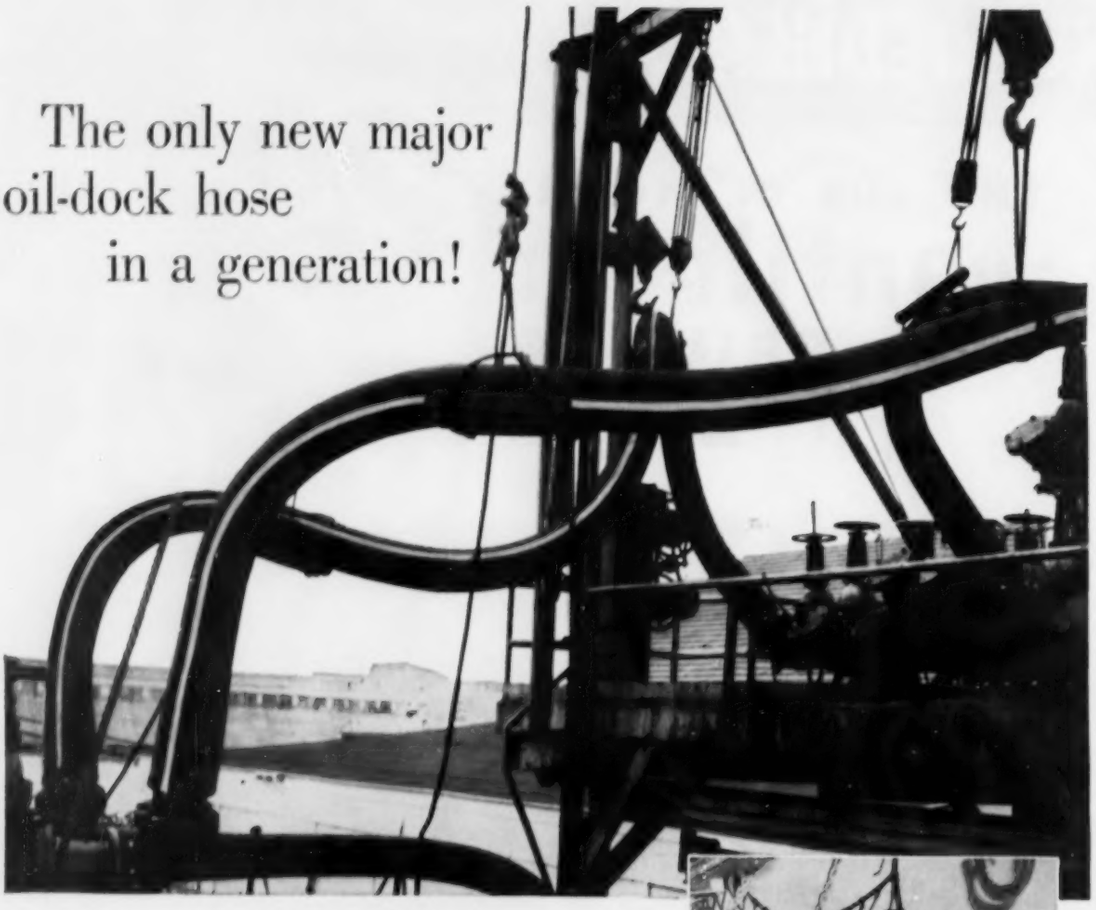

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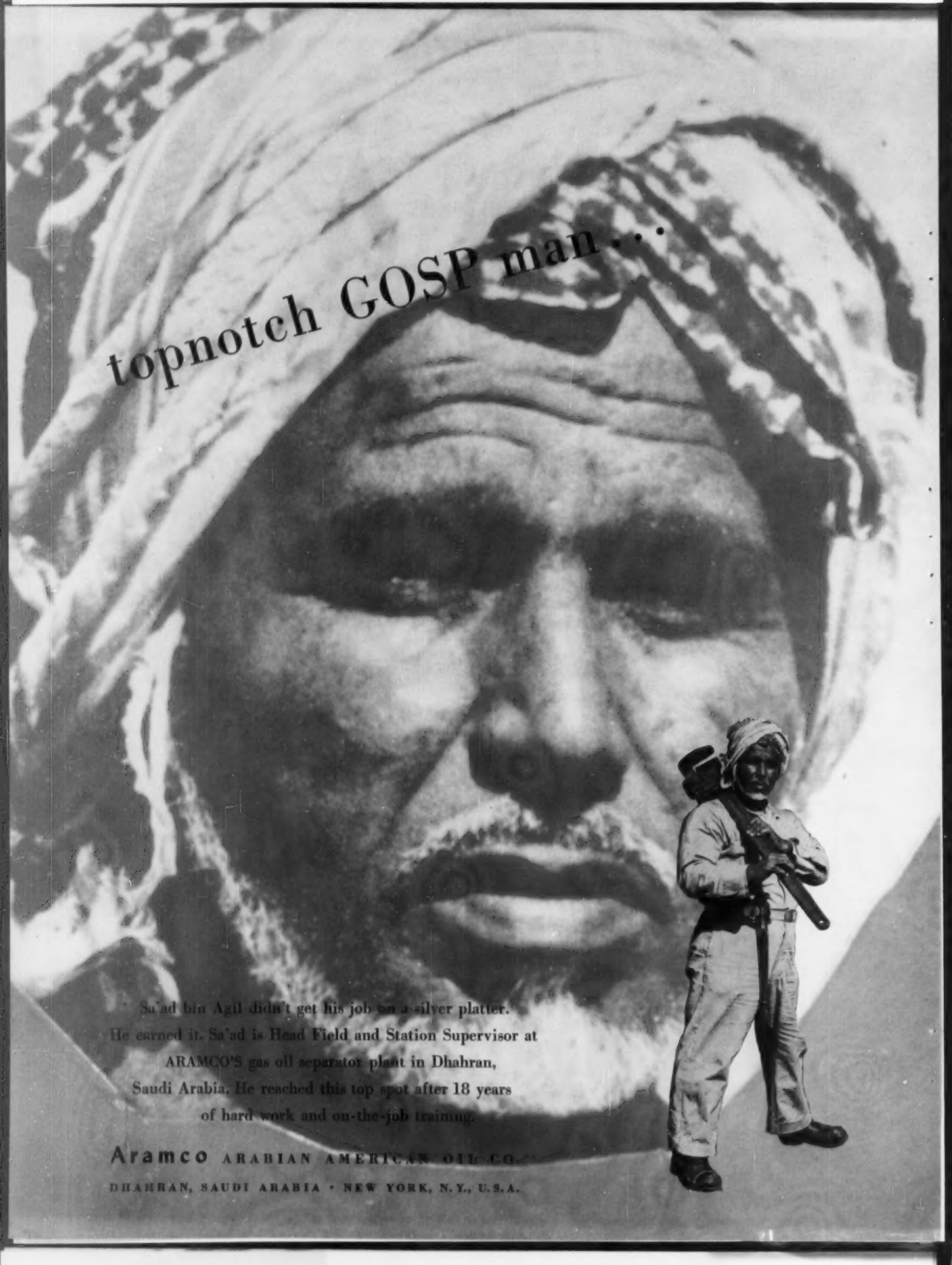
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VOL. 26, NO. 6, JUNE, 1955

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FOURTH WORLD PETROLEUM CONGRESS ISSUE

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Vice President
The Lummus Company
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Dear Mr. Barrere:

It is with a great deal of satisfaction we advise you and The Lummus Company of your outstanding performance and the remarkable record you achieved in the construction of our refinery here at Corpus Christi. The contract with your company was signed on February 6, 1952; groundbreaking ceremonies were held March 12, 1952, and you completed the refinery in eighteen months under the most adverse conditions and scarcity of materials. The expediting of the materials and the know-how of engineering and construction methods are the two prime factors in this record breaking completion.

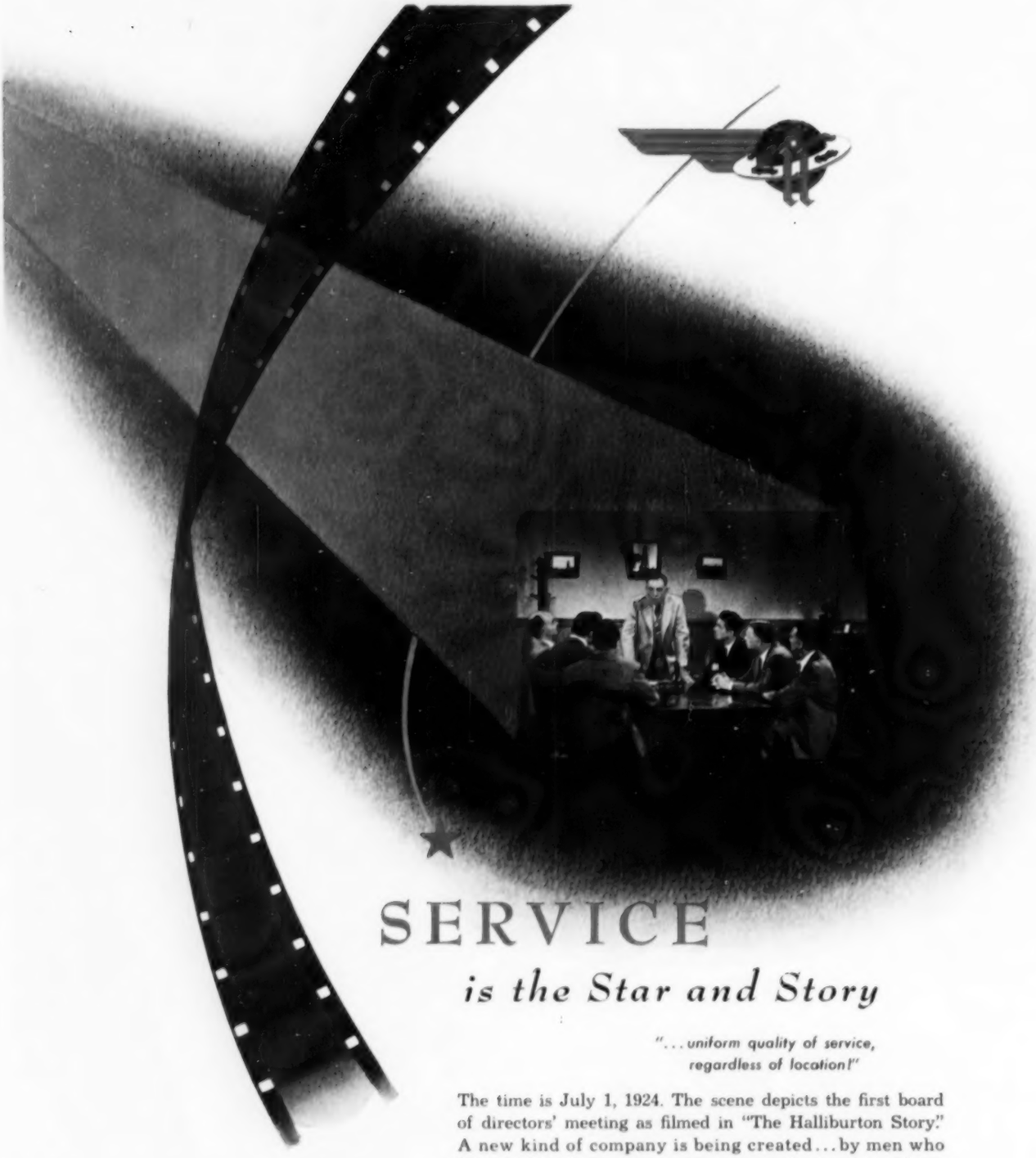
In starting up this plant, the topping and vacuum, fluid catalytic cracking, gas concentration, polymerization, and alkylation units each were staffed with completely new personnel. Your operators started up each of these units, and each and every unit was accepted after a few days' performance test. In fact, the whole plant was accepted much sooner than would ordinarily be the case under these circumstances.

We are very happy with all phases of the plant. As a matter of fact, it has operated at a greater capacity than originally planned. I am pleased to advise that in all of my refining experience, I have never witnessed a more satisfactory installation, and all of us here at Suntide are very proud of our refinery's performance as well as its appearance.

We would appreciate your extending our sincere compliments for a job well done to all members of your organization who had part in the building of Suntide.

Yours very truly,

FLM/h



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PROGRESS IN SERVICE THROUGH RESEARCH

By Prof. Marcello Boldrini
President of Fourth World Petroleum Congress

welcome

TO THE WORLD CONGRESS

I AM DEEPLY GRATEFUL to Mr. Mayo for giving me the opportunity to present, in the columns of WORLD PETROLEUM, a first cordial salutation to all those who, from every part of the globe, have convened for the Fourth World Petroleum Congress.

Above all, I cannot omit expressing my satisfaction over the selection of Rome as the seat of this Congress. In the honor accorded to Italy as host to this great periodic outturn of the petroleum industry I, and all my compatriots, see an international recognition of the progress made by our country during the past decennium in this fundamental sector of economic activity.

In effect, in Italy there is not any phase of the exploration, production and utilization of hydrocarbons wherein, in the years following the second world war, there have not been registered developments of great promise. In the extraction of natural gas, Italy, starting from zero, in less than ten years has attained a volume of three billion cubic meters, which is the highest in Europe. This country's network of natural gas pipe lines, about 4,000 kilometers (2,400 miles) is the largest on the continent and second (though naturally on a far smaller scale) to that of the United States. In European refining capacity, now above 24 million tons of crude per annum, Italy is in third place after Great Britain and France. Its fleet of tank ships, which has undergone rapid expansion after almost complete destruction during the war, at the end of 1954 exceeded a million tons deadweight. It is now in sixth place in the world and third in Europe after Great Britain and Norway.

Finally, by a conjuncture which I must characterize as fortunate, the preparatory phase of this Congress has coincided with the discovery in various parts of the country of petroleum deposits, the importance of which has not yet been defined with precision, but which seem of a nature that could radically alter the fundamental base of the

Italian economy. In fact, there is reason to foresee the possibility not only of covering, within a few years, the entire need of crude oil for the internal market, but also of having, in succeeding years, a notable excess for export.

Members of the Congress who will visit not only the petroleum refineries, or the central thermo-electric power stations fed by natural gas, but also the major industrial installations, many of which are using natural gas as a source of energy, will have an opportunity to verify personally how Italy in the past decade not only has replaced what was destroyed by war, but has done much more. It is not by chance that the index of industrial production in 1954 exceeded that of 1938 by 70 percent.

The fraternal aid of the United States has been a decisive factor in the expansion of the Italian economy; for this we are deeply grateful to the American people to whom I wish to express, in this column, the full acknowledgement of my compatriots. But American aid alone will not be sufficient to put the economy of Italy on its feet without the labor and the spirit of sacrifice of all her own people. It is my wish that members of the Congress, besides viewing the structures and all the beauties of nature and art that have made Italy a Mecca of world tourism, may also during their sojourn obtain an idea of the enormous material and moral difficulties which our people still have to meet and overcome.

All our guests from abroad who know our country are convinced that in whatever may affect external peace and interior democratic liberty, Italy will know how to make its contribution to the consolidation of the West. Since petroleum is a powerful instrument for economic progress, and since a "boom" in petroleum seems imminent in our country, it is eagerly expected that the present Congress, which includes so many eminent technicians from all parts of the world, will give further stimulus to exploration, production and utilization of hydrocarbons in Italy itself. For this reason, and not solely as President of the Fourth World Petroleum Congress, I thank all those who have come to Rome and will make valuable contributions from their study and experience.

I also heartily thank the Permanent Council of the Congress for having selected Rome as the seat of the present Congress. I extend thanks also to the National Committees in the various countries who have collaborated actively with the General Committee in the complex work of organization.

I am proud to welcome the Fourth World Congress to my country and to the environs of the Eternal City. I am secure in the confidence that I am expressing the thoughts of the General Organizational Committee in extending to all those who participate in the Congress my very best wishes.

OIL'S SERVICE

By Col. S. J. M. Auld*

IT IS LESS than one hundred years since the sinking of the first oil well in Pennsylvania. Much has happened in that brief span, and doubtless many of us have wondered what the world would have been like today had Colonel Drake and all subsequent drillers found only salt water instead of petroleum. Modern progress has been built on oil. Without it the piston-type internal combustion engine would be something of a curiosity, and without the internal combustion engine mechanization as we know it could scarcely have begun. More than likely there would be no flying, no submarines and little encroachment by high roads upon the railways for transportation purposes. The absence of liquid fuel would have resulted in entirely different development of the maritime industries, of naval strategy, and for all power production needs.

Liquid hydrocarbons lead the way both as raw material and as intermediates for organic synthesis. Coal tar has been supplanted from pride of place as the main source of the prodigiously fecund aromatic hydrocarbons, so that the dyestuff and drug industries are mainly dependent upon petroleum, as are the makers of explosives, solvents, plastics and synthetic fibers. Added to these are the other activities which are dependent on

President, Institute of Petroleum (London), and Honorary Treasurer of the World Petroleum Congress.

TO THE WORLD

mineral oil, such as the production of detergents and the artificial rubbers.

Considering, therefore, the extent to which modern industry and, indeed, the community as a whole are dependent upon oil, in addition to the added efficiency it brings to so many other activities, it becomes realizable that the past ninety-odd years have truly ushered in a petroleum era. Wherever oil arises or wherever it is introduced, it raises the standard of living. Comfort, transportation and luxury quickly follow in its train. It is the unsurpassed possession and almost in itself a universal currency. Indeed, the greatest attribute of oil probably is its universality. It may be for these reasons that the petroleum industry has become such a joint interest of its followers as well as being their profession. Indeed, the Cult of Oil may be something less than a religion, but it is more than an industry. It is a world brotherhood. And for that purpose it has its signs and symbols, and a common terminology and literature.

With such beliefs and such followers, it is natural that there should exist in the oil world a great movement toward personal association and exchange of knowledge. That spirit is what the World Petroleum Congress stands for. It is interesting to note that despite the relatively limited extent of their oil interests, the British, more than any other nationality, have consistently striven for mutual understanding and standardization. The World Petroleum Congress was in fact a British invention and arose chiefly in the minds of two men, A. E. Dunstan and T. Dewhurst, both past-presidents of the Institution of Petroleum Technologists.

Until the Third Congress, there had been no official participation by the United States. The tail had, indeed, been doing its best to wag the dog. Fortunately, unofficial support from the United States by submission of papers and by personal attendance had grown with each successive Congress. This interest culminated in the great step taken during the Hague meeting of establishing a national committee in America pledged to support future Congresses officially and fully.

Immediately following this, the election of Dr. E. V. Murphree of the Standard Oil Development Co. to the chairmanship of the Permanent Council of the Congress stabilized the whole situation. Moreover, there has arisen the hope, rapidly ripening into an expectation, that the Fifth Congress in 1959 will be held in the United States as part of the anticipated celebrations attending the centenary of the sinking of the Drake well.

The Institute of Petroleum may well be proud of the part it has played in the foundation of the World Petroleum Congress and in the internationalizing of petroleum technology. If humanity is to benefit to the greatest extent from this wonderful gift of oil, it must do so by the exchange of knowledge and thought on an ever-broadening basis. Only by increasing the girth can we aspire to the heights which we know to be still hidden from us.

Permanent Council is Heart of WORLD CONGRESS

FROM THE TIME of the first planning of the World Petroleum Congress which met in London in 1933, it was the purpose of the organizers that the movement thus begun should be a permanent one and that other gatherings should be held from time to time to exchange information on technical progress and on fresh problems of the industry. The success of the first meeting and the enthusiasm it generated gave impetus to the idea, and before final adjournment the officers of the Congress were asked to serve as a committee to arrange a time and place for the next meeting.

The task thus imposed was executed by the selection of Paris and the year 1937 for the second Congress. The fact that a world exposition was to be held in the French capital may have influenced the selection as likely to assure a generous attendance. At a meeting of the executive committee of the First Congress in October 1936, the decision was confirmed to hold the second Congress in Paris June 14-19 of the following year under the sponsorship of the Association Française des Techniciens du Petrole. An organizing committee consisting of leading members of the French petroleum industry was formed and took charge of arranging the program for the meeting.

It was at the close of the Paris meeting that the Permanent Council of the Congress was established under that name with members to be chosen from the national committees that had cooperated in the preparation of arrangements for the Second Congress. Col. Louis Pineau, who held the position of honorary president of the committee organizing that Congress, was selected as the first chairman of the Council. Representatives of Austria, Belgium, France, Germany, Holland, Poland, Romania, the United Kingdom and the United States made up the membership of the Council.

While it could not be foreseen at the time that fourteen years would elapse before another World Petroleum Congress could assemble, the creation of the Permanent Council was unanimously accepted as an essential step. In the light of succeeding events, however, it must be regarded as a main factor in maintaining the continuance of the organization and perhaps has been the only means of its survival.

Under the leadership of Col. Louis Pineau, the Council held its first meeting in October 1937, following the adjournment of the Paris assembly and at that time it was decided to hold the next session in Berlin in the first half of 1940. Further Council meetings to consider plans for this proposed Congress were held in Brussels and in Dusseldorf in the first quarter of 1939, but the start of World War II in September of that year put an end to any further consideration of the matter, and economic conditions in Europe following the war made the possibility of an early convening of the Congress out of the question. Col. Pineau remained as the titular head of the Council up to the time of his death and meanwhile the organization had a fixed abode as a result of the resolution for its creation which provided that its headquarters should be the office of the Institute of Petroleum in London and its permanent secretary should be the Secretary of the Institute.

In 1949 the Royal Institute of Engineers of the Netherlands extended an invitation to meet in The Hague in 1951. At a meeting of the Council in June 1949, this invitation was accepted and May 26-June 6, 1951 was appointed for the meeting there.

With the determination of the time and place for holding the Third World Con-

Dr. E. V. Murphree

G. A. Tuyl Schuitemaker

H. S. Gibson

Carlos Perez de la Cova

S. Scheer

F. S. Clulow

H. G. Vesper

R. Navarre

Prof. H. Weiss

H. Küpper

Günther Schlicht

F. P. Malschaert

gress, an organizing committee was formed in Holland with G. A. Tuyl Schuitemaker, a member of the Royal Institute of Engineers, as president. This committee took charge of arrangements for the Hague Congress and, in collaboration with the Council and the national committees established in various countries, completed the plans for the most widely representative Congress held up to that time.

At the close of The Hague meeting the election of new membership of the Council resulted in the unanimous choice of Dr. E. V. Murphree of the United States as chairman and H. S. Gibson of Great Britain, Dr. C. Perez de la Cova of Venezuela, Serge Scheer of France and G. A. Tuyl Schuitemaker of the Netherlands as vice chairmen.

With the passage of time the Permanent Council has become an indispensable part of the World Petroleum Congress. It not only acts as an administrative body in the intervals between Congresses, but it is a senior advisory group aiding in shaping the programs for the meetings of the full body. Working through the national committees, it aids powerfully in assuring the high technical standard of the papers presented before the successive Congresses. The experience of its members in helping to direct previous international gatherings contributes to the efficient handling of the mechanics of Congress meetings and its advice on matters both of policy and procedure has contributed greatly to giving the Congress its unique position among deliberative bodies in the field of modern industry.

The personnnel of the Permanent Council as presently constituted includes the chairman and four vice chairmen named above, Col. S. J. M. Auld (Great Britain) as honorary treasurer, D. A. Hough (Great Britain) general secretary, and the following members: F. S. Clulow (United States), H. G. Vesper (United States), M. R. Navarre (France), Prof. H. Weiss (France), Dr. H. Kupper (Austria), Prof. P. Erculisse (Belgium), Prof. F. P. Malschaert (Belgium), P. R. de Ryckere (Belgium), Dr. R. K. Stratford (Canada), Dr. G. Schlicht (Germany), A. J. Bermudez (Mexico), J. A. Beukers (Netherlands), Dr. J. N. J. Perquin (Netherlands), Prof. C. Padovani (Italy), Prof. G. Roberti (Italy) and Ing. T. A. Salvadori (Italy).

The Council, representing eleven nations, held meetings in preparation for the Fourth Congress at the conclusion of the Hague meeting in Brussels in 1952, in Rapallo, Italy, in 1953 and in Rome in 1954 and again in 1955.

Among the matters decided at these meetings was the confirmation of Rome as the site for the Fourth Congress. Numerous other questions had to be weighed and decided before and after this decision. Among the more important was the subject of technical topics which would be appropriate presentations at the Congress. The question of general lectures had also to be settled and selections made. All the while, of course, numerous administrative arrangements, including various legal and financial affairs, the establishment of special committees and agreement upon a provisional program, had to be ironed out.

Countless work-a-day details were examined by the Council, then put into effect by the diligent Organization Committee. In this and other ways, the Permanent Council has tried to provide continuity for the quadrennial events. Its guiding purpose has been to keep alive and healthy both the form and the spirit of the Congresses which, through their non-political and non-commercial exchange of information and ideas, can contribute significantly to the technological progress of the petroleum industry.

Dr. R. K. Stratford

Prof. G. Roberti

T. A. Salvadori

Antonio J. Bermudez

J. A. Beukers

D. A. Hough

ITALY'S WELCOME MAT for thousands of visitors assembling for the Fourth World Petroleum Congress rests comfortably on the projection of a new oil field discovered in the rugged hill country of the Abruzzi, less than 100 miles east of ancient Rome. And the citizens of the Eternal City, where oil of one kind or another has been used for everything from the lamps of the Vestal Virgins to the fuel tanks of the modern Vespa, the nation's ubiquitous motor-scooter, extend a welcome all the more enthusiastic because of the encouraging outlook for the home oil industry.

In the relatively quiet third-floor offices of a sedate palace at 20 Via Tevere, plans have been in the making for many months past to greet, shelter, fete, transport and entertain the visitors from more than 35 nations who are converging on Rome as the result of an effort begun over three years ago.

It was in 1952, shortly after the Third World Petroleum Congress in The Hague, that the Unione Petrolifera, acting for a membership which includes every oil company in Italy, extended to the Permanent Council of the World Petroleum Congress an urgent invitation to hold its fourth session in Italy.

ORGANIZATION OF THE FOURTH CONGRESS

By Ed Hill

"It was the idea not of one man, but of several leaders of the industry who attended The Hague meeting," said Dr. Arturo A. Muston, Esso Standard Italiana executive and general secretary of the Fourth World Congress.

"Since acceptance of the invitation by the Permanent Council, we have been involved with this," he added with a smile, waving his hand in the direction of a busy staff sorting correspondence, preparing memos, answering insistent telephones, checking hotel reservations (everyone, it seems, wants a suite in one of Rome's luxury hotels), and reading proofs of papers and announcements in the three official languages — English, French and Italian.

The peak of activity at 20 Via Tevere will be reached on Saturday, June 4, and Sunday, June 5, when the reception office will be open from 9 a.m. to 7 p.m. for the registration of delegates. Then the scene will shift to the rolling green hills of Rome's Universal Exhibition Grounds (EUR), reminiscent in scope and architectural splendor of the World's Fair held at New York in 1940. All of the plenary sessions of the Congress will be held at the fair grounds, just a few miles from Ostia Lido, the seashore playground of Rome's two million inhabitants, and the lush acres of the forest of Castel Fusano.

In preparation for the ten days' sitting of the Congress in Rome and collateral activities extending to all parts of Italy, a vast amount of work has been under way for more than two years. It has engaged the active participation of the leaders of every organization connected with hydrocarbon development in Italy and a large corps of able assistants. Beyond this, it has enlisted the cooperation of leading members of the industry in more than thirty countries of the world, working through national committees and subcommittees to assemble a program of over two hundred papers dealing with every phase of industry activity for the technical sessions of the meeting and it has received the constant attention of the international membership of the Permanent Council and their representatives in supervising general policy and essential details of the proceedings.

The keen interest of the Italian Government in the success of the Congress is evidenced by the fact that President Gronchi has consented to act as Patron of the event.

A first step in the important work of preparation for the Congress was the establishment of the General Organizing Committee, consisting of executives of the principal Italian oil companies, educators, members of technical associations and representatives of governmental bureaus.

As chairman of the General Organizing Committee and President of the Congress, an outstanding figure in the Italian petroleum industry has been selected. He is Prof. Marcello Boldrini, an authority on statistics and head of the Faculty of Economics and Commerce of the University of Milan. He is also president of Azienda Generale Italiana Petroli (AGIP), the vast producing and marketing section of the Ente Nazionale Idrocarburi (ENI), the government sponsored agency which controls much of Italy's petroleum and natural gas production.

Professor Boldrini, in addition to being a vice president of ENI and the chief executive of two other oil organizations, is a vice president of the International Statistic Institute and of the International Union for the Scientific Study of Population, a member of the Superior Council

View of the Foro Italico, where Rome hopes some of the 1960 Olympic events will be held.

Church of the Trinity of Monti, Rome, and the Spanish Steps.

Aerial view of the Basilica of St. Peter, adjoining the Vatican palace.

Castel S. Angelo, Rome.

The Arch of Titus.

The ultra-modern railway station at Rome.

The Fountain of the Naiads, Piazza Esedra, Rome. The Grand Hotel is in the background beyond the central jet.

The celebrated Trevi fountain.

The Triton fountain by Bernini, Piazza Barberini.

of Statistics, and president of a commission which currently is studying ways and means to revive the island of Sardinia as a productive economic unit of Italy.

Prof. Boldrini has been functioning as chief executive of the Congress and chairman of the General Organizing Committee since the latter was established shortly after Unione Petrolifera's invitation to Rome had been accepted. Associated with him in the capacity of vice chairmen are Dr. Vincenzo Cazzaniga, president of Esso Standard Italiana; Gaetano D'Amelio, chairman of the Unione Petrolifera and a director of Shell Italiana; and Marchese Filippo Pennavaria, president of STOI, a refinery in Florence.

One valuable working member of the committee was lost through the untimely death of Marchese Teodolo Theodoli, a former director of Petrolcaltex and a member of the General Organizing Committee from its inception.

Under Professor Boldrini's direction, several special committees were established. For the onerous task of collecting and editing the great number of papers to be presented before the Congress, Prof. Carlo Padovani, head of Italy's Fuel Experimental Station at Milan, was appointed as chairman of the Technical Division, a tribute to his high scholarship and broad technical knowledge.

Chairmen of other special committees are Mario Mortara, managing director of

The Organ fountain, Villa d'Este, Tivoli.

The Walk of 100 Fountains, Villa d'Este, Tivoli.

Piazza Navona, Rome. Fountain of Neptune.

CONDOR, Editorial Committee for Congress Proceedings; Dr. Vincenzo Cazzaniga, vice chairman of the General Organizing Committee, Hotel Reception and Tourist Committee; Marchese Filippo Pennavvaria, Vice President of the General Organizing Committee; and Dr. Giorgio Erberto Kovacs, general manager of IROM, Committee on Finance.

As this was being written, a Ladies Committee was in the process of organization under the chairmanship of Mrs. Renata Boldrini, wife of Prof. M. Boldrini, who is assisted by 19 ladies of high position, including the Countess Germain Carrobio di Carrobio, Countess Teresa D'Amelio, Marchesa Volanda Pennavaria, and Princess Luciana Pignatelli Aragona Cortes. It is charged with welcoming the wives and daughters of delegates and arranging special entertainment programs for them during the course of the Congress.

It works in close conjunction with the Hotel, Reception and Tourist Committee, which includes such experts at entertaining visitors to Rome as Don Francesco Massimo Lancellotti, chairman of the Provincial Tourist Association of Rome; Enrico Linzi, general manager of CIT, the Italian Tourist Company; and Costantino Parisi, superintendent of the famed Rome Opera.

These two groups will be among the busiest during the ten-day duration of the

Prof. Filippo Pennavaria

Dr. Vincenzo Cazzaniga

Gr. Uff. Gaetano d'Amelio

Dr. Mario Mortara

Victor J. Decorte

Gr. Uff. Alberto Gardella

Congress. A full social program, which calls for formal dress on only two occasions, has been carefully dovetailed into the general program.

This phase of Congress activity will begin in the famous Campidoglio (City Hall) on the evening of June 6, when Mayor Salvatore Rebecchini tenders a reception in the palaces and gardens on historic Capitoline Hill.

Delegates will be able to stroll through the Capitoline Museum, a treasure-house of Greek and Roman sculpture, and the art gallery, filled with the masterpieces of Italian and foreign artists, in buildings which were designed by Michelangelo and which offer a majestic view of the Roman Forum, the Palatine Hill and the great dome of St. Peter's across the Tiber.

On the following evening, Tuesday, June 7, the Unione Petrolifera will be host at a symphony concert, conducted by the noted Fernando Previtali with the orchestra of the Santa Cecilia Academy, the world's oldest musical organization. The concert will take place in the open air Basilica de Massenzio, work on which was started in the third century A.D. by Maxentius and completed by his successor, Constantine.

On Wednesday, June 8, the official banquet of the Congress will be held in the Excelsior Hotel, favorite hostelry of the international society set and a one-time rest camp for the American Fifth Army during World War II. All vestiges of the GI "occupation" have been erased by time and the expenditure of thousands of lire, and the banquet will be one of the two occasions on which formal dress will be obligatory.

For those who do not want to don evening dress, the Congress has arranged an international variety show at the Sistina Theatre, one of Rome's largest, and the home of such Italian comedy favorites as Totó and Carlo Dapporto, plus a chorus drawn from all parts of Europe.

Two performances of Giuseppe Verdi's "La Traviata" will follow next on the social calendar. They will be given on Friday, June 10, and Saturday, June 11, at 9:30 P.M. The national committees of the various nations represented at the Congress will distribute tickets for the two performances. This is the second and final formal attire affair on the program.

The feminine contingent at the Congress will come into its own at 5:30 P.M. on June 7. A combined tea and fashion show at the Excelsior Hotel will give them a glimpse of the Roman cocktail hour in full swing and a special exhibition of some of the Eternal City's most noted dress designers.

On this occasion creations will be shown from the workshops of such well known stylists as Simonetta, her husband and competitor, Faniani, the Fontana sisters, Schuberth, Cappugi and any of a dozen

Dr. Giorgio Kovacs

Dr. Sergio Ara

Prof. Attilio Jacobini

Count Mario Corrobio di Corrobio

Dr. Camillo Matter

Ing. Diego Guicciardi

Ing. Giacomo Fauser

Comm. N. Peretti

other fashion leaders who have brought Italian design to the front since World War II.

Italy's Ministers of Industry, Commerce and Education will collaborate on Monday, June 13 at an official reception at the National Roman Museum, a stone's throw from Rome's modern post-war railroad terminal building and just a few cobble-stoned yards across Piazza Esedra from what some visitors consider the most exciting of the city's myriad fountains.

Delegates will be able to conduct topical conversations against a rich background of Greek and Roman art in the museum, which occupies a portion of the remains of the Baths of Diocletian, one of the greatest monuments of Imperial Rome. (Another section was transformed into the present Church of Santa Maria degli Angeli by Michelangelo.) Among the Greek masterpieces of sculpture on display are the Maiden of Anzio, the Venus of Cyrene, and the Throne of Aphrodite.

In addition to these highlights, there will be daily half-day tours of Rome and the environs during the Congress. They will include most of the city's museums and monuments, the Colosseum, the Pantheon, the Forum, Castel Sant'Angelo (from where Tosca leaps to her death in the opera of the same name), the Vatican Galleries, Vatican Museum, St. Peter's and the major basilicas of Rome.

The tours, morning and afternoon, will also take in the modern monuments of Rome, the Foro Italico (which Italy hopes will be the site of the 1960 Olympic Games), the University Center, and Cinecitta, the most important single unit in Italy's motion picture industry, which boasts the largest sound stage in Europe.

Special excursions will take visitors to the mountain town of Tivoli, some 15 miles away, for a look at the fabulous fountains of Villa d'Este.

On Saturday, June 11, another tour will include the monuments of Rome by night and a flood-lighted view of ancient history.

On the "free days" of the Congress, June 9, 11 and 12, motor buses will fan out in all directions from the Eternal City on special trips designed to acquaint visitors with more of the Italian countryside.

One caravan will visit Orvieto, home of fine wines and the frescoes of Luca Signorelli; another will swing through the Alban Hills and pass through Castelgondolfo, the summer home of Pope Pius XII; a third will go to Ostia Antica (which rivals Pompeii as a spectacle), and the Lido di Roma; while a fourth will go north to Civitavecchia, once the port of ancient Rome, and Tarquinia, in the heart of what was once the Etruscan country.

A two-day excursion on June 11-12 is a little more ambitious. It will go to Orvieto, the university city of Perugia and historic Assisi, bringing the delegates back to town in time for dinner on Sunday night.

Special railroad trips to Naples are scheduled on June 9 and June 12 for delegates who wish to attend the International Exhibition of Oil Equipment on the grounds of the Mostra D'Oltremare, just outside the picturesque port city.

Delegates who, for one reason or another, cannot take advantage of the guided tours will be able to amuse themselves easily in one of the world's most interesting capital cities.

In the ten years since the end of the war, Rome has become a metropolis of nearly 2,000,000 people, with smart shops, night clubs and fine restaurants and with virtually continual sunshine between May and October.

Arrangements have been made for adequate transportation to and from the EUR and Rome, and delegates will have the opportunity to see Europe's newest subway, the Metropolitana, which numbers among its stops the Colosseum and the ancient Gate of St. Paul at the cemetery where Keats and Shelley are buried.

Subway trains run from the main railroad terminal directly to the site of the Congress and will augment the regular bus service and special buses which will be operated from convenient locations in the city by the Italian Tourist Co. (CIT) during the Congress.

Dr. Raffaele Vismara

Dr. Francesco Zurlini

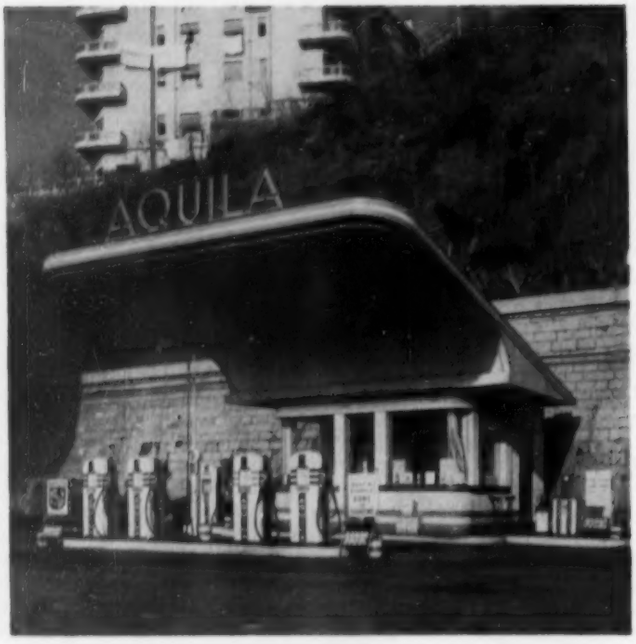
Ing. Gianni Robert

Prof. Ardito Desio

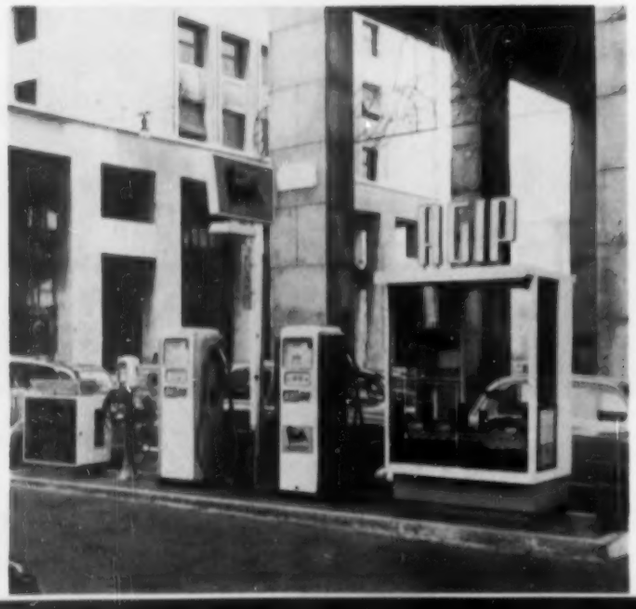
Dr. Giovanni Spantigata

A modern Italian filling station.

Petroleum



Filling station of the kiosk type.



A typical curbside station.

PRIOR TO World War II, Italy's reliance on sources of energy for industrial use was mainly upon coal. Second place was occupied by electricity, chiefly produced from water power. The war changed that situation by cutting off the most convenient rail supplies of coal, while postwar prices of solid fuel rose to heights that made its employment uneconomic. From the time when the country's economic recovery began in the middle forties, liquid fuels in the form of natural gas and residual fuel oil have increasingly cut into the position formerly held by coal.

Fortunately, the available supply of both of these fuels has been greatly expanded, the first by the discoveries of gas in the Po Valley and the second by the rapid upbuilding of Italy's refining industry. Table I shows the change that has taken place since the prewar year of 1938. For a clearer comparison, the proportion contributed by each has been converted into the equivalent in terms of 1,000 metric tons of fuel oil and the trend has been carried forward to the year 1959 to indicate its probable future course.

Domestic requirements of the Italian market for petroleum products for the current year in metric tons is stated as 8,262,000, which compares with a consumption in 1938 of 1,885,000 tons, nearly a fivefold increase. The demand for the various products is shown in Table II along with consumption in 1938. In the earlier year, LPGas products were not in market demand and oil had not come into use for domestic heating. These are capable of great future expansion. The outstanding gains in consumption thus far, however, have been shown in residual fuel, diesel oil and motor gasoline. With the exception of aviation gasoline, which is not made in Italy, the greater part of the remaining consumption is supplied from local sources. As the table shows, there has been only a slight increase in the demand for kerosine due to the fact

marketing in ITALY

that there has been a general shift from kerosine motors to diesel power for farm equipment.

Growth in the consumption of gas is shown by Table III in millions of cubic meters, with estimates up to 1959 to show the effect of the present trend.

Gas produced in the Po Valley is distributed by a network of pipe lines with a combined length of about 2,000 miles to the industrial areas extending across northern Italy. The present number of consumers is estimated at about 2,000 and includes chemical factories, iron and steel plants, electric power, textile, mechanical, glass and building industries. The price charged to industrial consumers for gas is tied to the selling price of residual oil and coal on the basis of calorific yields. Gas reserves are estimated at 90,000 million cubic meters, which represents approximately 17 years' supply at the estimated 1959 consumption rate of 5,500 million cubic meters, which is about the equivalent of 6,600,000 tons of coal.

The 34 refineries of Italy have an authorized processing capacity of 22.5 million metric tons or about 462,000 barrels daily.

As shown in Table II, the product chiefly in demand is residual fuel oil. The growth in post-war use of this product is in great part a change from coal to liquid fuel by large industrial establishments. It is estimated that this has reduced coal consumption by some two million tons from what it otherwise would be under present industrial conditions. To an extent the adoption of natural gas by industrial plants is estimated to have contributed to this change by 700,000-800,000 tons annually.

A new factor that has entered into this situation is the use of light fuel oil for domestic heating. Such usage is capable of considerable expansion if the charges for such use are reduced.

LPGas products are also coming into increasing use as the available supply from Italian refineries expands. Of the current demand for these products, about five percent comes from industrial establishments and the remaining 95 percent from domestic users, 70 percent of this being in rural areas. It is estimated that there are about 2,800,000 users of LPGas with some 6,800,000 bottles of the conventional five gallon capacity in circulation. Increasing production of LPGas by Italian refineries is expected to provide for growing requirements of these products.

Farm use, particularly by motor tractors, has contributed markedly to the growth in the demand for diesel oil, and represents about 25 percent of total consumption. This is due to the tendency of farmers to change over to diesel-powered tractors instead of kerosine type units and accounts for the decrease forecast for kerosine sales. Most of the sales to the farm trade are made through the "Consorzi Agricoli Provinciali" (Provincial Farm Consortium), of which there is one in every province with branches in all rural towns. These Consorzi head up to the "Federazione dei Consorzi Agrari" with headquarters in Rome, which supervises the organization and functioning of the CAP's. The Federation contracts for nation-wide supplies of products (not only petroleum products, but also fertilizers, seeds and agricultural machinery) which are then allocated to the various local organizations. These are, however, free to make their own supply arrangements if they so desire.

The Consorzi Agricoli Provinciali sell to the farmers on long credit terms with payment after the sale of crops. They have their own bulk distribution plants for oil products in main centers and smaller depots in scattered rural centers. Besides these Consorzi there are individual dis-

TABLE I
TREND OF FUEL CONSUMPTION
(1,000 Metric Tons)

Type of Fuel	1938	1955	1956	1957	1958	1959
Coal	9,763	7,665	7,475	6,995	6,658	6,412
Electricity	5,328	12,936	13,524	14,448	15,372	16,296
Natural Gas	15	2,940	3,360	3,780	4,200	4,620
Residual Fuel	942	4,180	4,450	4,720	4,940	5,160
LPGas	....	17	20	22	25	26
Totals	16,048	27,738	28,829	29,965	31,195	32,514

TABLE II
CONSUMPTION OF PETROLEUM PRODUCTS
(Metric Tons)

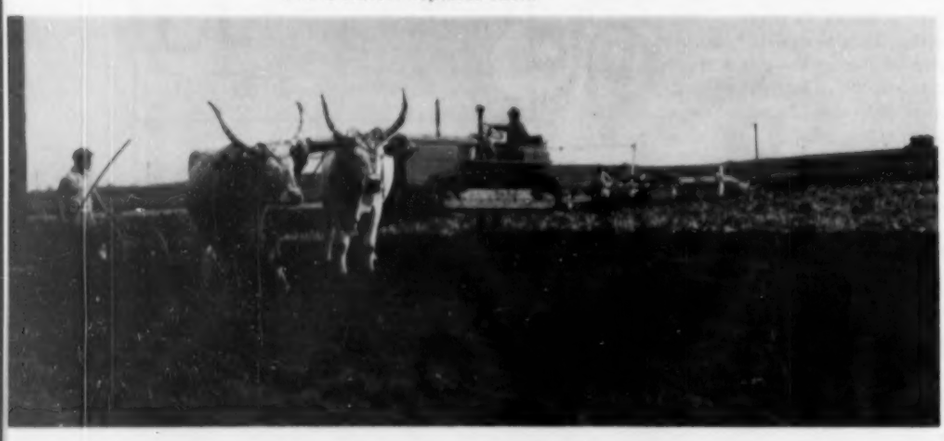
Type of Fuel	1938	1955
Aviation Gasoline	31,000	35,000
Jet Fuel	.....	38,000
Motor Gasoline	400,000	1,290,000
Diesel Oil	265,000	1,564,000
Kerosine	167,000	185,000
Heating Oil	.....	520,000
Residual Fuel	942,000	4,180,000
Lubes	80,000	170,000
LPGas	.....	280,000
Totals	1,885,000	8,262,000

TABLE III
CONSUMPTION OF NATURAL GAS

Year	Millions of Cubic Meters
1938	18
1955	3,500
1956	4,000
1957	4,500
1958	5,000
1959	5,500

View of the petroleum basin for tanker loading and unloading in the harbor of Naples.

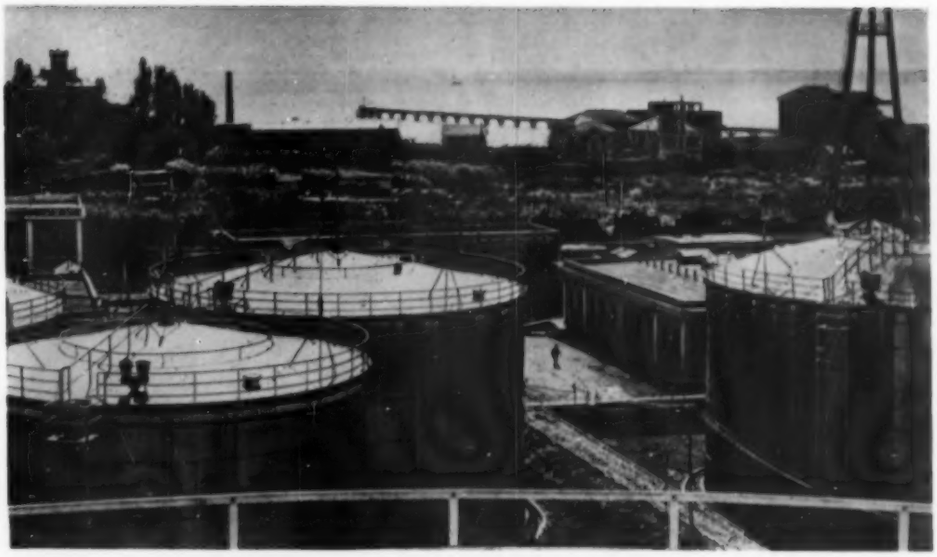
The old and the new on an Italian farm as the tractor replaces oxen.



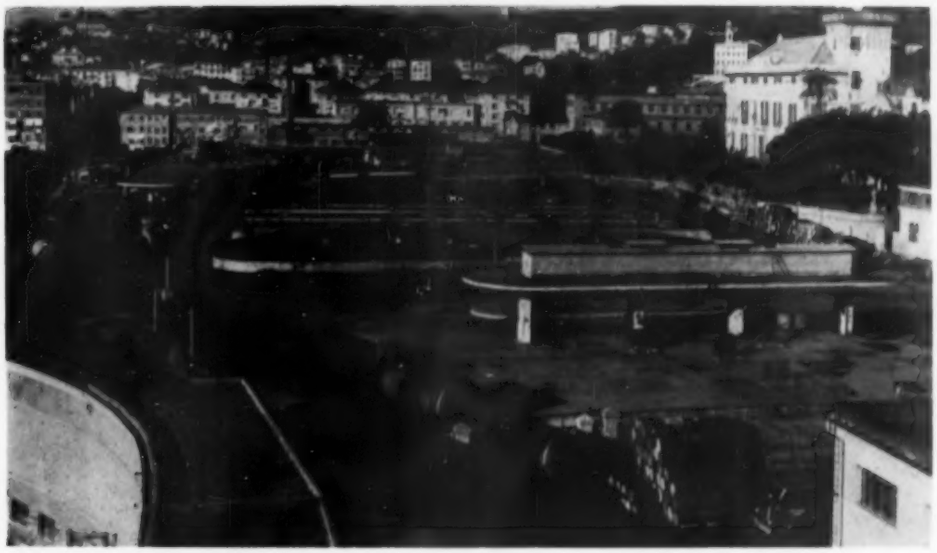
tributors handling sales and distribution of petroleum products to farmers in more or less the same manner.

The large increase in diesel-powered trucks also accounts for a considerable share in the increased demand for this product.

The use of motor gasoline in Italy is restricted by the heavy taxation imposed upon it, but consumption has risen threefold since the pre-war period. The current price at the pump is about 128 lire for regular grade or 75.5 cents per gallon, of which 71 percent or 55.18 cents represents tax. About 82 percent of the motor fuel is sold in the standard grade leaving 18 percent for special brands. The use of premium grades has been decreasing and



The Savona terminal of Petrolcaltex.



The Carmagnani bulk plant, Pegli-Genoa, handles all products and all tankage underground to comply with municipal regulations.

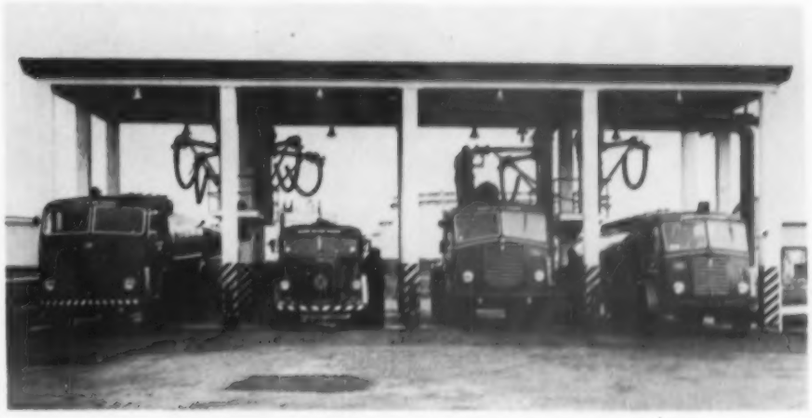
may fall further because of the improvement in the octane rating of the regular grade, which has risen from 66/67 RM in 1949 to 84/86 at the present time with premium classification up to 90/92 RM.

The number of motor vehicles in use in Italy has increased rapidly since 1949 and now totals over 3,500,000, classified as follows:

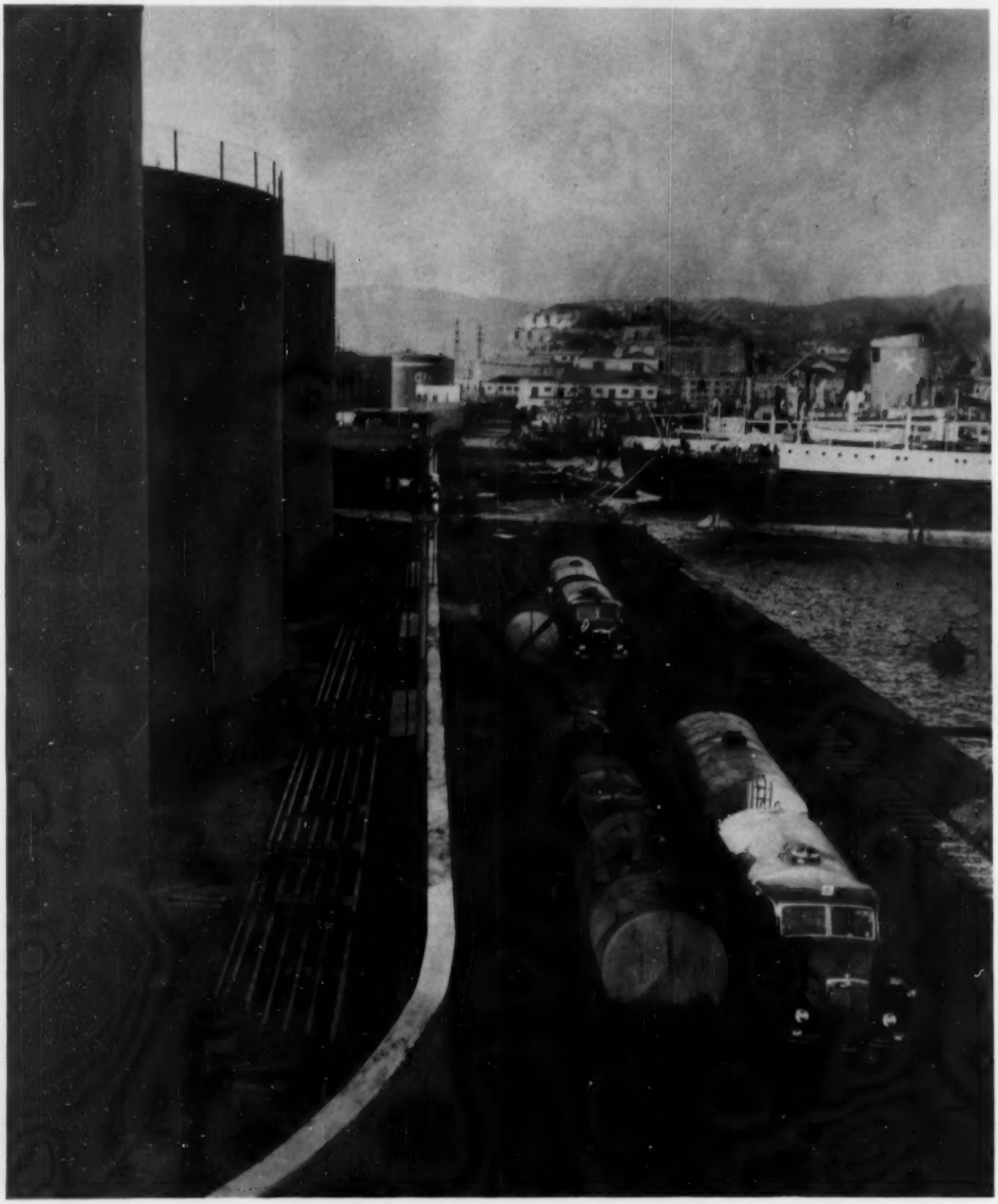
Motor Cars	815,750
Trucks	326,000
Motorcycles	300,000
Scooters and Motorbicycles	2,038,000
Busses	17,500
Farm Tractors	140,057
Total	3,639,307

As shown by the above, the omnipres-

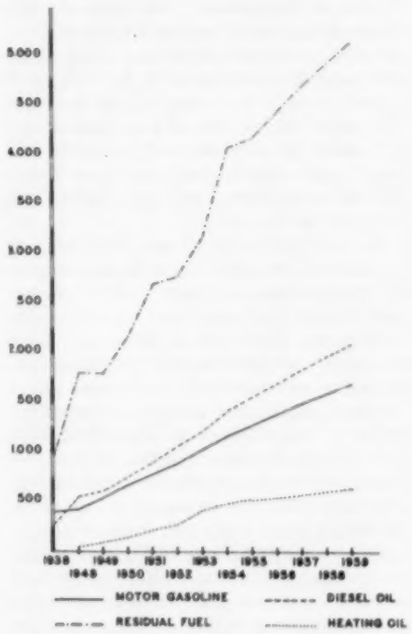
The loading rack at SVI bulk depot, Naples: gasoline, kerosine and diesel.



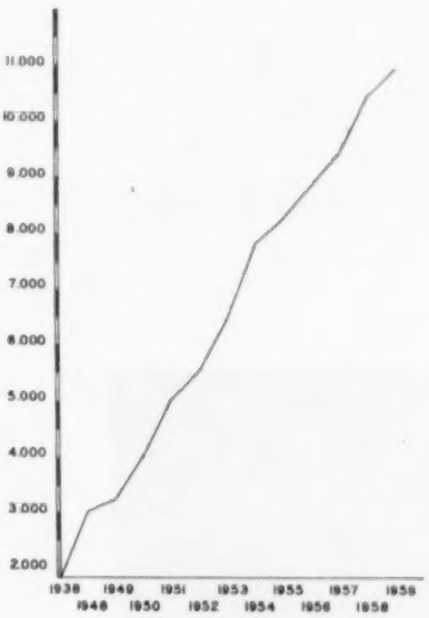
View of the tanker terminal and loading station at Genoa.



Growth in Italian consumption of gasoline, diesel oil, residual fuel and heating oil with forecast trend of market demand: 1938-48 to 1959. (Thousands of metric tons.)



Growth in Italian consumption of petroleum products with forecast trend of market demand: 1938-48 to 1959. (Thousands of metric tons.)



Growth in Italian consumption of kerosine, LPG and lubes with forecast trend of market demand: 1938-48 to 1959. (Thousands of metric tons.)

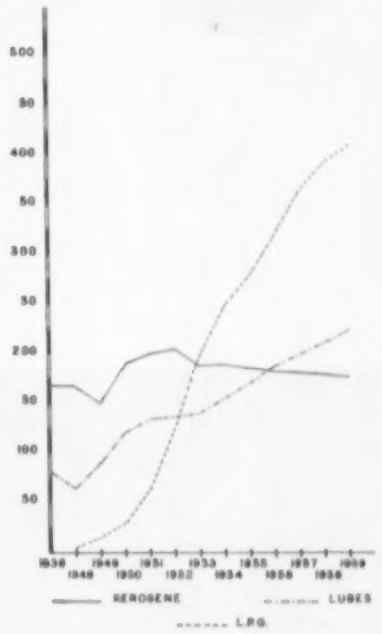


TABLE IV

MARKETING OUTLETS FOR PETROLEUM

Outlet	1950	1951	1952	1953	1954
Service Stations	208	343	476	851	1,027
Filling Stations	1,848	2,208	2,509	3,835	4,473
Curbside Sites	5,349	5,686	7,159	7,864	8,324
Totals	7,405	8,237	10,144	12,550	13,824

TABLE V

PUMPS OPERATING IN SERVICE STATIONS

Type of Pump	1950	1951	1952	1953	1954
Gasoline	11,820	12,847	13,950	18,478	20,706
Diesel Oil	4,545	4,960	5,291	5,748	6,277
Fuel Mixture for Scooters	....	....	2,258	6,589	8,241
Totals	16,365	17,807	21,499	30,815	35,224

ent scooter characteristic of Italy far outnumbers any other type of motor vehicle, but at the present rate of increase, it is expected that privately owned passenger cars will exceed the million mark in another two or three years. Rapid gains are being made also in diesel powered trucks and farm tractors. Per capita consumption for the whole population averages only about nine gallons yearly, however.

Distribution of petroleum, except direct deliveries from refineries to a few large consumers, is handled through 35 to 40 coastal terminals and 100 or more inland bulk plants equipped to handle all principal products; these in addition to small plants dealing in one or a few products. Deliveries from coastal refineries to port terminals are made by large and small tankers and barges. Bulk shipments to inland points are made by railway tank cars and by road trucks of which there are approximately 3,000 to 3,800 respectively, in use.

There are six major oil marketers who are refiners as well as merchandisers and some 30 other organizations of varying size, some maintaining refineries, who cover local marketing areas. In addition there are 25 to 30 concerns limiting themselves to lubricating oils, besides a great number of resellers of lubes.

To meet the needs of the retail purchaser there are three types of vendors. There is the service station familiar in most countries where cars can be washed, greased and perhaps serviced in other ways in attached garages. Secondly, there are filling stations which are to be found on city thoroughfares and main highways between towns where supplies of gasoline, gas oil and lubricants are on sale, but no services to cars provided. Next are the curbside stops consisting usually of a couple of pumps with no drive-in facilities and at most only a small kiosk to shelter the operator in inclement weather. A feature in most of these outlets is the mixtometer pump, which has been evolved to meet the demand for a gasoline-lube oil mixture for the ever-growing array of motor scooters. These pumps are very ingenious and can deliver a mixture containing five to ten percent of lubricating oil as required.

Competition in the marketing field is very keen, particularly in gasolines and gas oils, and has led to a rapid increase in the number of sales outlets in recent years. Table IV accompanying shows the growth in number of these during the past five years.

The number of pumps installed in these stations during the same period is shown in Table V.

MEETING PLACE OF

THE SITE SELECTED for the Fourth World Petroleum Congress is in all respects a fortunate one. As its name (EUR), Rome Universal Exhibition, indicates it was designed as a world center for the demonstration of modern progress as well as for the display of relics of a historic past. Specifically it was planned to house a "Universal Exposition of Civilization," an ambitious project planned for 1942 but made impossible by the outbreak of World War II more than two years before the date set for the event.

Before the work of preparation was suspended the grading and landscaping of the grounds had been completed and two buildings had been erected: the Palace of Civilization, intended as a museum, and the Congress Building, designed to be the meeting place for international conferences and the conventions of world associations or scientific bodies during years to come. For this, be it noted, was not to be the temporary housing usually provided for exposition use; the buildings were to be the work of distinguished architects and to be constructed of steel and marble for endurance through ages. The whole district was intended to be a new and distinctive quarter of the Eternal City.

For a time it appeared, however, that it would become only a monument to thwarted hopes. It was not until 1952 that the Italian government and the civic authorities of Rome combined efforts for completion of the development with some changes suggested by altered conditions. The present conception is a new city center containing residential buildings as well as public edifices and convention facilities.

This new garden city of marble and bronze, statues and fine architectural features, with miles of paved streets,

The Marconi column at the Rome Universal Exhibition, site of the Fourth World Petroleum Congress.

Panoramic view of the exhibition grounds with the Palace of Congresses right center.

THE WORLD CONGRESS

arcades, gardens and natural parks of palms and eucalyptus, is about five miles from the center of Rome and is reached by bus lines and the newly completed subway from the city's railway terminal. The central feature of the new quarter is the Guglielmo Marconi square and tower. Beyond this square are the approaches to two museums already completed and to the Congress Hall where the sessions of the World Petroleum Congress are being held. This structure, of characteristically modern style, was designed by architect Adalberto Libera and is considered one of the most interesting modern buildings of Rome. Its floor space is over two and one half acres. The entrance is through a portico lined with columns and leading to the reception hall immediately preceding the main hall which serves as a gathering place for delegates. The walls, over 130 feet in length, are decorated with varicolored marbles and have well-placed exits leading to upper galleries and floors.

On the second floor are the registration desks, offices of the Congress organization, rooms for sectional meetings and various service quarters. On the roof there is a broad terrace which commands a view of the park, the surrounding buildings and a panorama of the countryside for miles around with the Alban hills in the distance and the Castella Romana and Monte Cavo closer at hand.

Among the buildings in the central group are a restaurant, newly completed, where a thousand guests can be served, an open air theatre seating 1,400 persons, the Hemicycle, with its curving arcades, and other attractive buildings forming part of this permanent establishment of EUR. Facilities available at the headquarters meet all the needs of delegates and visitors who are concerned with the affairs connected with the Congress.

Restaurant building on the EUR grounds.

View from the main entrance at Naples' Mostra d'Oltremare, showing pavilions, Tower of Nations and Palace of Congresses.

The Petroleum Exhibition at NAPLES

AS AN ADJUNCT to the Fourth World Petroleum Congress at Rome, an exhibition of petroleum equipment is being held in Naples extending from June 5 to June 20, thus overlapping the Congress session by several days. The site of the exhibition is the Mostra d'Oltremare or Overseas Fair, situated at the gates of the city, about one and a half miles from the business center. The grounds are equipped with a series of single-story buildings or pavilions especially adapted to the display of machinery, the whole placed in a setting of natural beauty and artistic decoration that gives the effect of an attractive park.

Aside from the numerous pavilions and porticos, there are open spaces suitable for the display of large equipment and larger buildings with halls and rooms adapted to meetings and conferences. Facing the central square of the exposition area is the Palace of Congresses which is designed especially as a meeting place for international gatherings. It contains a large conference room, 40 by 98 feet, with smaller meeting rooms for committee use and some 20 other rooms to serve as offices. Part of this same structure contains the Mediterranean Theatre, containing a large stage equipped for the presentation of technical addresses and having a separate movable section which may be adjusted to bring films or charts

to the near attention of observers. At one side of the square is the Tower of Nations, a ten-story structure with a roof belvedere for sightseers.

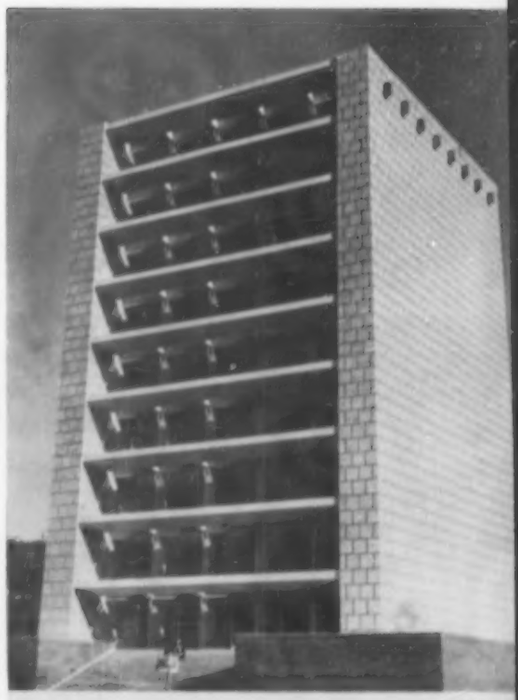
Other features of the extensive grounds are areas for sports events, well-appointed restaurants, a large swimming pool and an open air theatre, the Arena Flegrea, seating 10,000 persons. A central radio station transmitting the programs of the Italian radio system is located in the Mostra and 72 loudspeaker installations provide for retransmission to various parts of the grounds.

The hundreds of acres planted in lawns, gardens and trees, combined with the architectural beauty of different structures, make the Mostra D'Oltremare one of the most attractive parks to be found in Europe and render it especially lovely at night when illuminated by hundreds of flood lights. Interesting features that add to its attractiveness for visitors are the amusement park, housing the well stocked zoological gardens, and the botanic gardens and hot houses, where a wide variety of rare and unusual plants are grown. A children's theatre seats several hundred persons and is equipped for cinema and stage presentations.

Outstanding as a scenic attraction of the Mostra is the Fontana dell'Esedra (giant waterspout). It is divided into three sections, the Esedra proper, which is of semi-circular shape including a central pool, and four concentric crowns each including 19 trapezoidal pools. A large rectangular basin 60 feet wide and 750 feet long occupies the foreground. It is divided into 12 smaller pools and is flanked by 24 circular pools.

The electrical equipment for operating the fountains and jets is located in two power stations where nine electric pumps of 1,000 kw keep the more than 3,000 jets, spouts and cascades supplied. The three central jets of the Esedra reach a height of 130 feet. There are 132 flood lights for the central jet and the 12 jets of the crowns which are in four different colors. The entire lighting effect requires the use of 1,328 flood lights absorbing 420 kilowatts.

Aside from the practical aspect of the exhibition in displaying the many kinds of machinery and equipment employed by the petroleum industry, the many other attractions of the Mostra D'Oltramare are sufficient to draw the attention of visitors attending the World Congress. To satisfy this desire, the General Committee of the Congress has made special provisions for trips to Naples and the exhibition on days not occupied by sessions in Rome, while visits of a day or longer can be arranged at any time during or following the Congress, as the exhibition continues until June 20.



Tower of Nations at the Overseas Fair, site of the Naples exhibition of petroleum equipment from June 5 to June 20.

WORLD PRODUCTION

SINCE THE LAST meeting of the World Petroleum Congress at The Hague four years ago, world production of crude oil has increased 26.6 percent. In 1951 the average rate of output was 11,700,000 barrels daily, while today production is about 14,915,000 b/d.

Eastern hemisphere production has increased more in terms of volume and much more rapidly in rate. Output during the first quarter of the current year was 5,085,000 b/d compared with 3,596,000 b/d in 1951, an increase of 1,489,000 barrels on a daily average basis. In the western hemisphere the increase in volume was 1,350,000 b/d, from 8,480,000 b/d to 9,830,000 b/d.

Since the eastern hemisphere started from a much smaller base, the growth percentage has been much greater. Western hemisphere growth was 16 percent at the average rate of about four percent per year, while in the east the increase was 41.5 percent, a growth of over 10 percent per year.

In the United States the average rate of growth has been 2.7 percent per year. Elsewhere in the western hemisphere the annual rise has been 7.3 percent.

The increase in major geographical areas of the eastern hemisphere has been remarkably similar on a percentage basis. In the Near and Middle East the four-year growth has been 53 percent, an average rate of 13.2 percent per year. Europe, including the Soviet Union and its satellites, has experienced a similar rate of growth, 52 percent or an average of 13 percent per year. Oceania and the Far East has lagged with an increase of 34 percent, an average of 8.5 percent yearly.

Comparing current output with that four years ago, there have been some astonishing changes in individual countries. Iraq is outstanding. Production in that country in 1951 was 175,000 b/d. When Iranian oil was withdrawn from the market, the speed-up in pipe line construction from Kirkuk to the Mediterranean and from Basrah to the Persian Gulf provided means of moving greatly enlarged volumes of oil to market. Current production is about 630,000 b/d, an increase of 260 percent. During the period, Iranian production dropped from around 675,000 b/d to a low of 30,000 b/d. Offtake from Iranian fields now is rising again at a rapid rate. First quarter production this year was about 257,000 b/d.

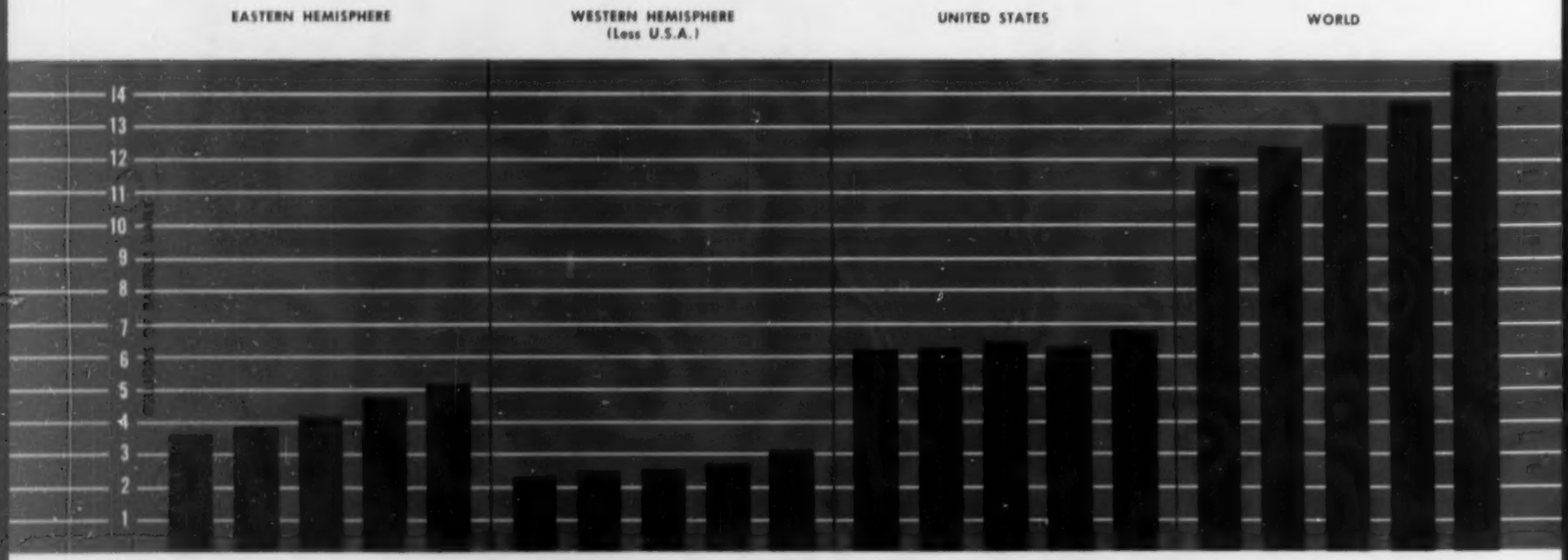
Kuwait is another prime example of vastly increased production. In the first quarter of 1951 Kuwait produced 380,000 b/d and in the first quarter of this year 1,061,200 b/d, an increase of 198 percent. Qatar is another country with greatly expanded output—from 42,000 b/d in 1951 to a current output of 100,000 b/d, a rise of 137 percent.

Saudi Arabia was further advanced at the time of the Iranian shut-down and has not increased as rapidly. First quarter output four years ago was 612,000 b/d compared with 951,000 b/d this year, a rise of 55 percent.

On a smaller scale there are a number of other countries in both hemispheres which have doubled their production. West German fields now are producing about 58,000 b/d compared with 24,000 b/d four years ago.

Recent new discoveries in France and Italy have given those countries large percentage increases although the volumes involved still are small when compared with major producing countries. The Parentis find has brought French continental output up to nearly 15,000 b/d compared with 3,600 b/d four years ago, a rise of 316 percent.

Even more recent have been the Italian discoveries. The new Ragusa field in Sicily now is producing 1,250 b/d and there are prospects of even greater additions to come from the Petrosud (Gulf-



Crude output is 26.6 percent higher than four years ago at the time of the last World Petroleum Congress. Greatest gains have been made in the Eastern Hemisphere.

Montecatini) discovery on the Adriatic coast which tested 2,000 b/d of 34 gravity crude.

There is a good deal of argument in the absence of detailed reports on Romania, but some western observers now think enough new oil has been found to raise output of that country to about 200,000 b/d, twice the 1951 level. Russian output is reported to have risen 50 percent in the same period.

In the western hemisphere Canada has been an outstanding example of rapid development. Current output of about 315,000 b/d compares with 100,000 b/d four years ago.

Argentina has found some new production lately, bringing current output up to about 92,000 b/d. This compares with an output of 65,000 b/d in 1951. Chile has increased its output nearly fivefold from 1,200 b/d in 1951 to 6,000 b/d currently.

The shifts in production have made a substantial change in the share of world markets enjoyed by various countries. The United States now produces 45.7 percent of world output compared with 52.2 percent four years ago. Russia produces 8.1 percent of the world's oil compared with 6.9 percent in 1951. Kuwait has jumped from 5.0 to 7.1 percent and Iraq from 1.5 to 4.2 percent.

There has been a growing tendency on the part of domestic producers in the United States to complain about the growth of imports for foreign oil into American markets. Government intervention has been sought. Thus far the administration has been against the application of artificial restraints aside from the present import duties.

Refiners on the Atlantic seaboard in the United States are increasing their importation of foreign crude because of low international tanker rates which make the imported crude more attractive from a cost standpoint. U. S. crude imports in 1954 averaged 656,000 b/d compared with 647,800 b/d in 1953 and 572,600 b/d in 1952. At the time of the last World Petroleum Congress, crude imports were averaging 490,600 b/d.

Indications are that crude imports into the United States will continue to rise as new plants are completed in Atlantic coastal states unless there is a reversal in present postings or transportation costs.

WORLD CRUDE OIL PRODUCTION
(Thousands of Barrel Daily)

	1954				1955
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	First Quarter
NORTH AMERICA					
United States	6,375.2	6,528.5	6,188.3	6,290.7	6,812.0
Canada	243.5	224.2	295.5	285.0	315.0
Mexico	218.3	230.5	229.6	235.0	235.0
Total	6,837.0	6,983.2	6,713.4	6,810.7	7,362.3
SOUTH AMERICA					
Venezuela	1,896.4	1,848.7	1,840.4	2,003.5	2,137.1
Colombia	114.7	113.4	106.1	103.9	104.0
Argentina	82.4	77.8	79.1	85.5	92.0
Trinidad	63.9	64.1	64.9	67.0	65.0
Peru	46.6	47.3	46.0	47.0	47.0
Ecuador	8.4	8.5	8.5	8.5	8.5
Chile	4.5	4.5	4.7	5.1	5.2
Brazil	2.1	2.1	2.1	4.0	2.5
Bolivia	4.3	3.3	4.3	4.1	6.0
Cuba	0.1	0.1	0.1	0.3	0.5
Total	2,223.4	2,169.8	2,110.2	2,328.9	2,467.8
WESTERN HEMISPHERE	9,060.4	9,153.0	8,823.6	9,139.6	9,830.1
EUROPE & AFRICA					
Austria	60.0	62.0	62.0	62.0	62.0
Germany	47.7	50.8	53.3	55.0	58.0
Netherlands	16.4	18.1	18.4	18.2	18.9
Hungary	14.0	14.0	14.0	14.0	14.0
France	7.4	7.8	10.3	14.5	14.5
Yugoslavia	3.0	3.0	3.0	3.0	3.0
French Morocco	2.4	2.6	2.4	2.5	2.5
Italy	1.6	1.5	1.4	1.5	2.8
Algeria	1.7	1.7	1.5	1.8	1.5
United Kingdom	1.3	1.2	1.2	1.2	1.2
Total (Exc. USSR & Sat.)	155.5	162.7	167.5	174.3	178.4
USSR	1,095.0	1,130.0	1,165.0	1,190.0	1,215.0
Romania	200.0	200.0	200.0	200.0	200.0
Poland	4.0	4.0	4.0	4.0	4.0
Albania	3.0	3.0	3.0	3.0	3.0
Czechoslovakia	2.5	2.5	2.5	2.5	2.5
Total	1,304.5	1,339.5	1,375.5	1,399.5	1,424.5
Total Europe	1,460.0	1,502.2	1,543.0	1,573.8	1,602.9
NEAR & MIDDLE EAST					
Kuwait	891.8	921.0	972.8	1,038.7	1,061.2
Saudi Arabia	951.2	978.8	937.5	943.1	951.6
Iraq	593.7	618.9	646.9	650.6	640.0
Qatar	97.0	96.6	98.6	104.5	101.0
Iran	39.5	39.9	33.5	152.0	257.0
Egypt	37.8	38.6	34.1	38.0	38.0
Bahrain	30.1	30.1	30.1	30.1	30.1
Neutral Zone	9.0	11.4	21.4	21.6	23.0
Turkey	0.6	0.7	1.3	1.3	1.8
Total	2,650.7	2,736.0	2,776.2	2,978.8	3,103.7
FAR EAST & OCEANIA					
Indonesia	204.9	209.7	227.2	233.0	242.2
B. Borneo	101.1	98.2	99.1	99.0	99.0
Japan	6.1	5.7	5.8	5.9	5.9
New Guinea	5.3	12.5	13.0	12.6	13.0
India	7.2	7.0	7.0	6.1	6.1
Pakistan	4.4	4.4	5.2	6.0	6.0
Burma	3.1	3.0	3.0	4.5	4.5
China	2.1	2.0	2.0	2.5	2.5
Total	334.2	342.5	362.3	369.6	379.2
EASTERN HEMISPHERE	4,444.9	4,580.7	4,681.5	4,922.2	5,085.8
WORLD TOTAL	13,505.3	13,733.7	13,504.1	14,061.8	14,915.9

Prof. Carlo Padovani

ITALY'S HYDROCARBON INDUSTRY

By Carlo Padovani and Alberto Girelli*

Alberto Girelli

Part I: Background and development

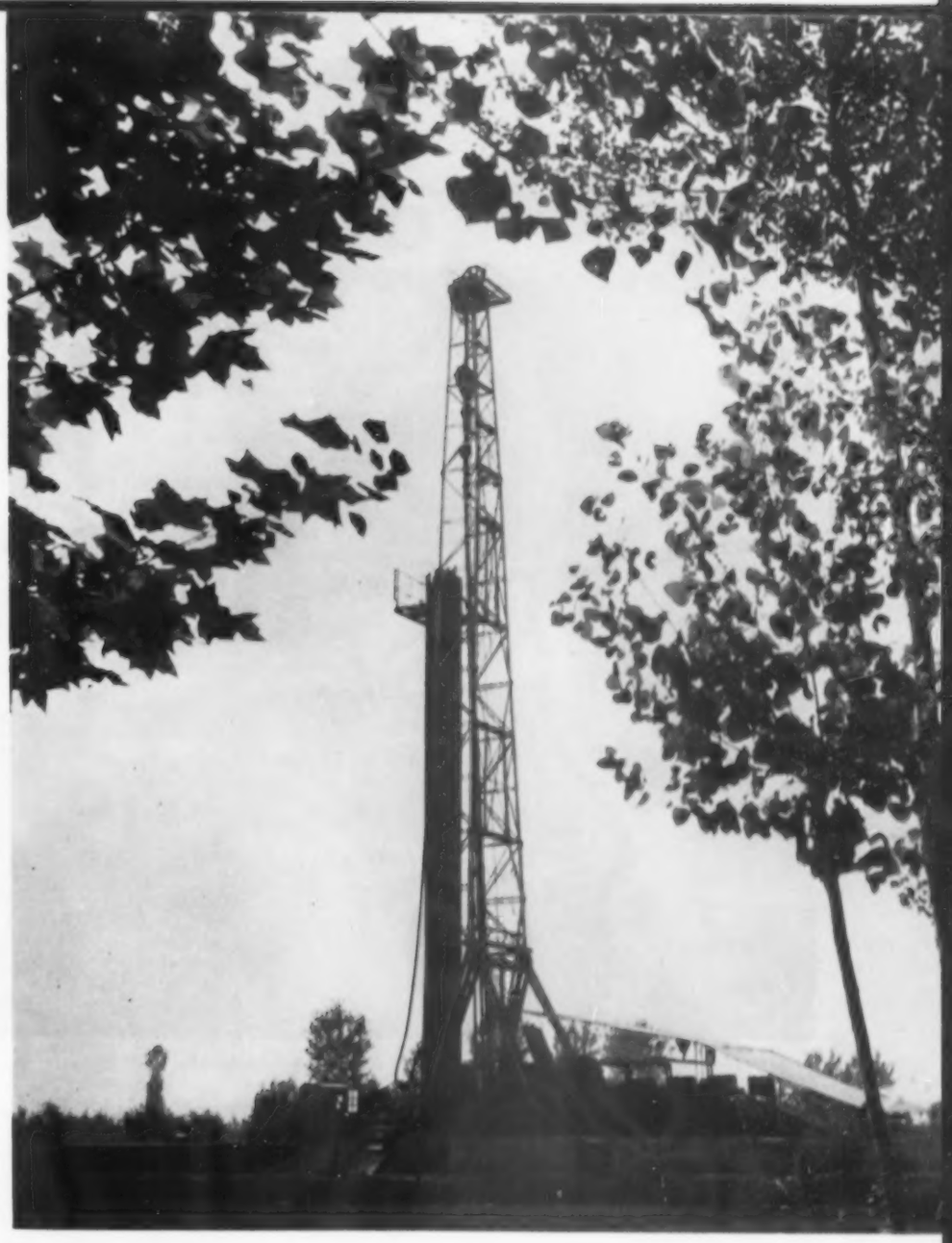
GASEOUS AND LIQUID hydrocarbons were first known, studied and used in Italy in quite ancient times. Writers and scholars of the Roman age like Plinius, Strabo and Lucretius referred to and described seepages of natural gas which assumed spectacular forms and not infrequently were the object of magic or superstitious rites, but sometimes were put to use, particularly in the pre-Apennine region. There is reason to believe that natural gas, for example, was employed to heat the Roman camps in the neighborhood of the ancient town of Velleja. In less remote periods, it is known that as early as 1820 some Italian towns like Genoa, Parma and Firenze were using oil-burning lamps for their public lighting. Italian naturalists and physicists, including Spallanzani, Volta, Galvani and Stoppani, carried out research and experiments in the eighteenth and nineteenth centuries on spontaneous eruptions or issues of natural gas accompanying volcanic phenomena, thermal or mineral water sources. A lime kiln in the Apennines near Modena undoubtedly was heated by natural gas early in the nineteenth century (Fuochi di Barigazzo).

More recently the composition, radioactivity and rare gases content of the spontaneous seepages at Salsomaggiore, Larderello, the Phlegreian fields and others have been studied by foreign and Italian investigators such as the French chemists Fouque and Gorseix, and Prof. R. Nasini and co-workers at the University of Pisa. It was only during and subsequent to World War I, however, that systematic geological surveys, geophysical or geoseismic prospecting and appreciable drilling were undertaken.

Two laws started off petroleum prospecting and production on Italian soil. One was the 1927 Mining Bill, which sanctioned the State's right to demesne over the subsoil, and set up a system of prospecting and of mining licenses governed by official regulations. These con-

**Stazione Sperimentale per i Combustibili, Milan.*

Italian seismic crew lines up near the Agrigento temple, Sicily.



Drilling in the Po Valley area. AGIP-Mineraria rig in operation.

cessions were granted to applicants "proving their technical and financial capacity" to whom alone indemnity was secured irrespective of the ownership of the surface. The second law, issued in 1926, set up the General Italian Petroleum Company (AGIP) for the precise purpose of systematic petroleum prospecting and surveying on behalf of the government, which alone supplied the funds.

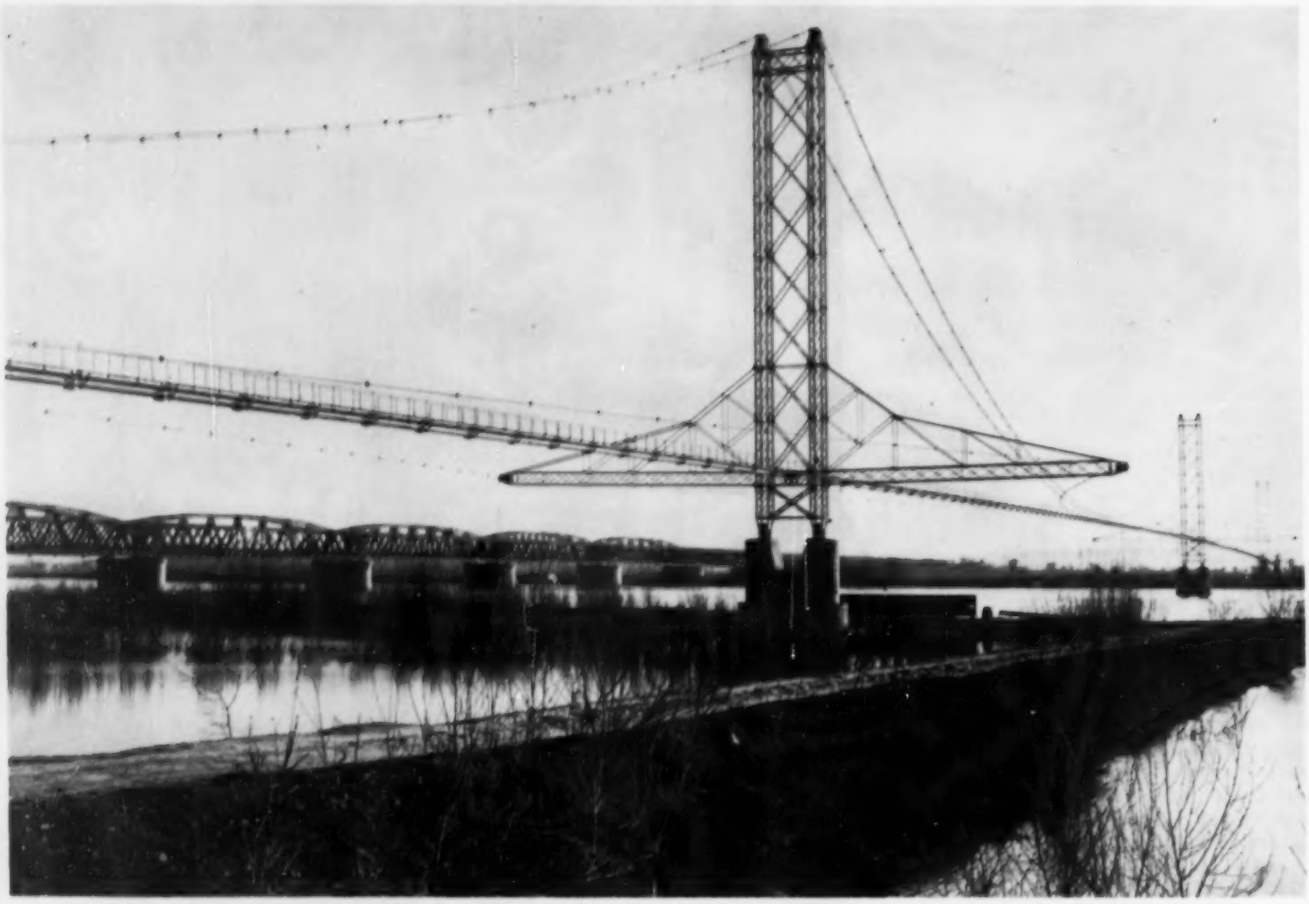
Another measure for promoting knowledge and exploitation of liquid and gaseous hydrocarbons, besides other fuels, was the opening of the "Fuel Section," now called the "Fuel Experiment Station." In 1928-1929 this Institute took over the task of discovering and studying the quality of the numerous spontaneous eruptions of gaseous hydrocarbons, and those associated with water and oil prospecting, with the intention of obtaining clues to the possible existence of oil and gas fields. In passing, mention should be made of a measure, now revoked, granting premiums on petroleum or bitumens produced in Italy, to enable domestic output to compete with imported oil produced under more favorable conditions. Over many years, this series of government measures did not yield appreciable fruits.

Petroleum production reached a peak of about 27,000 tons in 1932. Beside the AGIP, private companies produced the majority of the oil, among these the Societa Petrolifera Italiana (SPI), a subsidiary of Jersey Standard, accounted for about three quarters of the above figure. Besides prospecting on Italian soil, activity was undertaken by the government or government agencies (in conjunction with foreign companies) in Italian Somaliland, in Iraq, and in Albania. In the latter country the AIPA (a company financed by the Italian State Railroads) struck oil in the Devoli river area. Notwithstanding appreciable efforts, Albanian production has always been rather limited in comparison with the investments and the number of wells drilled. In 1939 production amounted to about one million barrels.

More extensive operations and greater successes were to follow in the natural gas field.

Prospecting and exploitation of natural gas was stimulated by the introduction of compressed natural gas in steel cylinders for powering motor vehicles. This innovation, notwithstanding the expense and considerable technical and safety problems it involved, was favored by particular conditions which justified the search for domestic fuel to replace petroleum gasolines, supplies of which were hindered by currency difficulties and by political and military reasons. On the other hand, this latter use, exempt of taxes, was the only one which could be made of the few, scattered sources of natural gas available up to about 15 years ago. The activity of some private companies in this field was at first directed to using, controlling and extending the spontaneous eruptions on the pre-Apennine hills, or those occurring at thermal sources or found when drilling for water.

Subsequently, considerable private activity, apart from actual prospecting and surveying, was developed in the Po river delta area (Polesine) where, at shallow depths in the sandy formations of alluvial quaternary, rotary drillings which took very little time to carry out revealed limited but numerous shallow natural gas fields, nearly always associated with salt water. Toward 1938, oil prospecting carried on by AGIP revealed for the first time at Fontevivo (Parma) and Podenzano (Piacenza), at the junction of the sub-Apennine formation with the Po valley, the existence of Miocene



Cortemaggiore-Caviaga pipe line of the Azienda Nazionale Metanodotti (ENI subsidiary) crossing the Po River near Cremona.

gas reservoirs at 2,400-3,000 feet depth. The Podenzano field has been connected to Milan by a 88 mm diameter pipe line, 42 miles long, supplying the natural gas for compression and distribution stations.

This reservoir yielded about seven billion cubic feet of gas before exhaustion.

Since the Po valley is a low plain, almost entirely covered by recent alluvial deposits, no surface geology could be usefully carried on in the area. It is therefore comprehensible that, before the advent of modern geophysical methods, petroleum was sought and found only in the pre-Apennine regions.

The AGIP, after adopting more up-to-date surveying methods, including reflection seismic, which was particularly successful, was able in 1944 to reach a much larger natural gas field located at a depth of 3,900 feet at Caviaga, near Lodi. This discovery was the point of departure for AGIP's highly productive gas prospecting in the Po valley. This region was recently declared by law an AGIP, and subsequently an ENI, monopoly, the latter body being a government agency controlling all state petroleum operations, including exclusive prospecting and production. After the strike at Caviaga many other structures were identified between 1947 and 1954, and important reservoirs were discovered in the upper Miocene anticlines below the alluvial roof. Some productive strata were also found at earlier and later levels. The gas in the majority of these wells is not associated with liquid hydrocarbons, but consists of practically pure methane, with no hydrogen sulfide and small quantities of inert gases and higher hydrocarbons. Nevertheless, the gas from one of the most important fields, Cortemaggiore, is especially rich in higher hydrocarbons, so that in 1951 it was considered profitable to set up a plant for gasoline and LPGas recovery. At a deeper horizon in the same field, oil was reached. The present production of crude of the Cortemaggiore field is about 60 thousand tons per year.

The natural gas output, coming practically entirely from the AGIP fields in the Po River valley, has risen rapidly year by year, touching the 2.9 billion cubic meter mark in 1954. In that year AGIP drilled a total of 60,000 meters of wildcats and a further 141,000 meters of production wells.

Prospecting other than in the Po River valley to discover oil and natural gas has been crowned with success in Sicily and Abruzzo (Central Italy). Oil prospecting in Sicily was commenced later than in the Po valley. In Sicily, the law on petroleum operations passed by the local authorities (Governo della Regione) allows all having the necessary technical and financial means to obtain prospecting and exploitation licenses, so that exploration has been intensified during the past few years. A number of licenses have been granted to Italian, foreign or mixed capital companies, besides AGIP.

The richest hydrocarbon potential in Sicily is indicated by extensive zones of bituminous rock near Ragusa. In this region the American International Fuel and Petroleum Co. (Gulf Oil Co.) has up to now drilled some wells at a depth of about 2,000 meters. The main purpose of these borings was to survey the stratigraphy of the Ragusa calcareous rock down to the metamorphic Paleozoic. These borings have traversed a whole series of strata, mainly calcareous, from the lower Miocene to the Jurassic, a stratum of basic rock, down to a calcareous marl (with traces of petroleum) and finally a formation of highly fractured dolomitic calcareous rocks rich in a heavy oil (19.8° API). Production wells have been drilled in this zone, and since

DOMESTIC CRUDE PRODUCTION (1938-1954)

Year	AGIP	Private Companies	Total
	Metric tons/Year		
1938	1,279	11,866	13,145
1946	2,675	8,146	10,822
1950	3,341	4,838	8,179
1951	13,765	3,881	17,646
1952	59,494	4,023	63,517
1953	81,915	3,372	85,287
1954	69,211	10,000(*)	79,211(*)

(*)Estimated. Sicilian production started late fall 1954.

DRILLING ACTIVITY IN ITALY (1938-1954)

Year	AGIP	Private Companies	Total
	Meters Drilled		
1938	10,006	16,181	26,187
1949	14,673	130,376	145,049
1950	54,340	110,699	165,039
1951	122,647	60,900	183,548
1952	128,563	62,529	191,092
1953	156,093	71,527	227,620
1954	202,164	.....	.....

ITALIAN PRODUCTION OF NATURAL GAS LIQUIDS (1938-1954)

Year	AGIP	Private Companies	Total
	Metric tons/Year		
1938	....	....	....
1946	....	397	397
1950	1,738	467	2,205
1951	3,310	486	3,796
1952	17,128	418	17,546
1953	32,130	429	32,559
1954	33,515	....	.....

DOMESTIC NATURAL GAS PRODUCTION (1938-1954)

Year	AGIP	Private Companies	Total
	Million Cubic Meters		
1938	....	....	17
1946	13	51	64
1950	305	204	509
1951	723	239	962
1952	1,179	256	1,435
1953	2,021	276	2,297
1954	2,692	300(*)	2,992

October 1954, 400 tons a day of crude have been shipped by rail to the nearby RASIOM refinery at Augusta. The company estimates a 1955 production of some 200,000 tons through six producing wells, some of them directional, as a part of the reservoir lies under the town of Ragusa.

Other exploration in Sicily includes that of the D'Arcy Exploration Co. (British Petroleum Co.) which has found showings of heavy oil at about 3,000 meters some 12 miles west of Vittoria (Ragusa); by Pacific Western, which has drilled a stratigraphic well near Agrigento encountering gaseous sand; and by the Mediterranean Oil Co. (Gulf Oil Co. and McMillan) which has drilled a stratigraphic well also near Agrigento, but found neither oil nor gas. In the plain of Catania, a company with mixed capital (AGIP and Italian private enterprise) encountered appreciable quantities of natural gas some time ago. Up to the present time eight wells have been drilled, the majority of which are productive. Local industries have for some time been using natural gas.

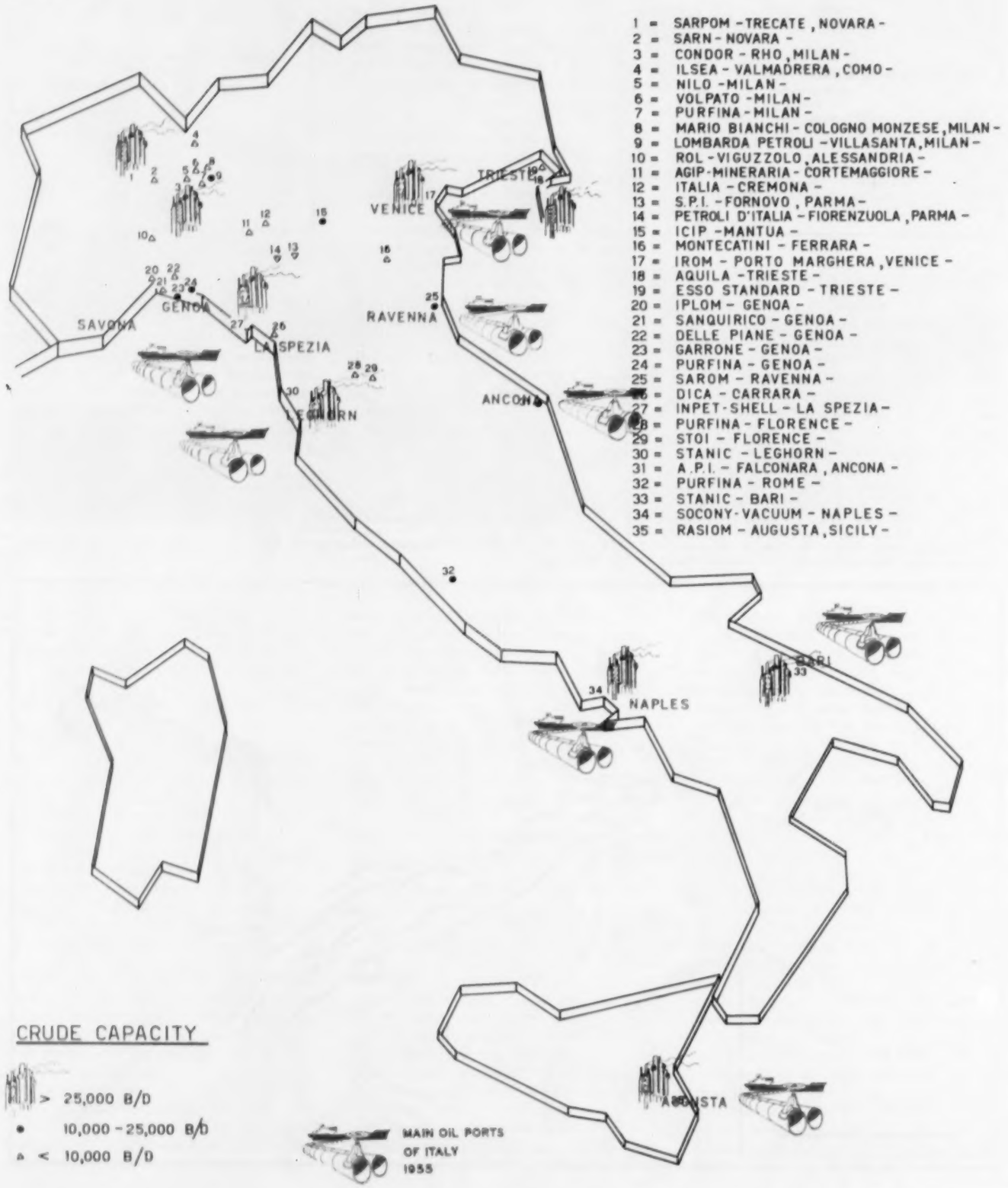
The discoveries made in Sicily encourage further exploration which is, however, hindered by the complicated stratigraphy of the island. The most promising area up to now has been that around Ragusa, but many other parts of the island are almost untested and it is possible that they may prove of interest in the future.

The discovery of good quality petroleum in Abruzzo by Petrosud (Montecatini-Gulf Oil Co.) has put in the limelight an area which previously seemed to be overlooked. Near Alanno (Chieti) a well drilled by Petrosud yielded oil at a depth of 770 meters (2,500 feet). Other wells are being drilled to assess the potential offered by this new area. First production tests on the discovery well have shown an average flow of 350-400 tons of crude per day. The well is situated on an upper Miocene anticline; productive strata are Mesomiocene organogenic limestones.

Sketch map of the Po Valley gas fields, January 1955, courtesy AGIP Mineraria. This is a simplified drawing of a detailed map, part of a paper to be presented before the Fourth World Petroleum Congress: T. Rocco, "Comparative Geological and Geophysical Study of the Po Basin."

REFINERIES AND MAIN OIL PORTS OF ITALY—1955

Data on crude and products disembarkment at the different ports (1954) are shown on page 109.


1 = SARPOM - TRECATE, NOVARA -
2 = SARN - NOVARA -
3 = CONDOR - RHO, MILAN -
4 = ILSEA - VALMADRERA, COMO -
5 = NILO - MILAN -
6 = VOLPATO - MILAN -
7 = PURFINA - MILAN -
8 = MARIO BIANCHI - COLOGNO MONZESE, MILAN -
9 = LOMBARDA PETROLI - VILLASANTA, MILAN -
10 = ROL - VIGUZZOLO, ALESSANDRIA -
11 = AGIP-MINERARIA - CORTEMAGGIORE -
12 = ITALIA - CREMONA -
13 = S.P.I. - FORNOVO, PARMA -
14 = PETROLI D'ITALIA - FIORENZUOLA, PARMA -
15 = ICIP - MANTUA -
16 = MONTECATINI - FERRARA -
17 = IROM - PORTO MARGHERA, VENICE -
18 = AQUILA - TRIESTE -
19 = ESSO STANDARD - TRIESTE -
20 = IPLOM - GENOA -
21 = SANQUIRICO - GENOA -
22 = DELLE PIANE - GENOA -
23 = GARRONE - GENOA -
24 = PURFINA - GENOA -
25 = SAROM - RAVENNA -
26 = DICA - CARRARA -
27 = INPET-SHELL - LA SPEZIA -
28 = PURFINA - FLORENCE -
29 = STOI - FLORENCE -
30 = STANIC - LEGHORN -
31 = A.P.I. - FALCONARA, ANCONA -
32 = PURFINA - ROME -
33 = STANIC - BARI -
34 = SOCONY-VACUUM - NAPLES -
35 = RASIOM - AUGUSTA, SICILY -
TRIESTE
VENICE
RAVENNA
GENOA
SAVONA
LA SPEZIA
LEGHORN
ANCONA
BARI
NAPLES
AUGUSTA
CRUDE CAPACITY
> 25,000 B/D
10,000 - 25,000 B/D
< 10,000 B/D
MAIN OIL PORTS OF ITALY 1955

Vacuum topping plant at the Raffinerie Siciliane Olii Minerali, Augusta, Sicily.

ITALY'S HYDROCARBON INDUSTRY

Part II: Development of the refining industry

PRIOR TO 1926 Italy (in terms of petroleum) was an outlet for the marketing of imported finished products. The two refineries, at Fiume and Trieste, which became Italian territory after World War I, and a few small distillation plants in northern Italy, produced but a small fraction of the domestic demand for finished products.

The petroleum processing industry in Italy was born in a rather unusual manner by cracking imported reduced crudes. Before 1926, in fact, not only finished products, but also imported crude was heavily burdened by custom duties. This made it practically impossible to establish a domestic refining industry able to compete with plants existing in other countries.

In November 1926, the Italian government passed a law granting custom exemptions to companies utilizing imported reduced crudes both on materials and machinery and on the raw material itself. Special tax exemptions on industrial profits for a ten year period were also granted in this connection. These measures promoted the installation of three cracking plants at Porto Marghera (Venice), Naples, and La Spezia. This constituted the first intervention by the government in the Italian petroleum industry. All three cracking plants employed the Dubbs thermal process, which at that time was in general use. The Naples plant, built by Italian private capital with participation by a Belgian group, was subsequently bought by Socony-Vacuum; the plant at Porto Marghera was taken over by AGIP; and the La Spezia plant was built by Royal Dutch/Shell, which signed an agreement with the Italian government granting the latter a share in profits.

Subsequent legislation, extending previously granted exemptions from reduced crude to crude oil itself, and transferring tax loads on finished products, enabled the three plants to be completed in 1933 to "complete cycle" refineries and furthered the erection of others. In 1935, another modern refinery, the Aquila, was built by private capital at Trieste. By 1936 the Italian refining industry was an accomplished fact, and in that year processed a total of 420,000 tons of crude.

In the meantime, a government enter-

prise, the AIPA (Azienda Italiana Petroli Albania) had carried out successful prospecting in the region of Devoli (Albania). The availability of raw material in a country within Italy's sphere of influence, but a few hours sailing from the important port of Bari, prompted the government to take another step in connection with the petroleum industry.

It was decided that Albanian crude would be processed by high pressure catalytic hydrogenation, for which an agreement was reached with the international company holding the Bergius-I. G. Farben patents. At that time this process was the only one by which, though at high production costs, premium gasoline of high yield could be obtained from a heavy sulfur and asphalt - containing crude.

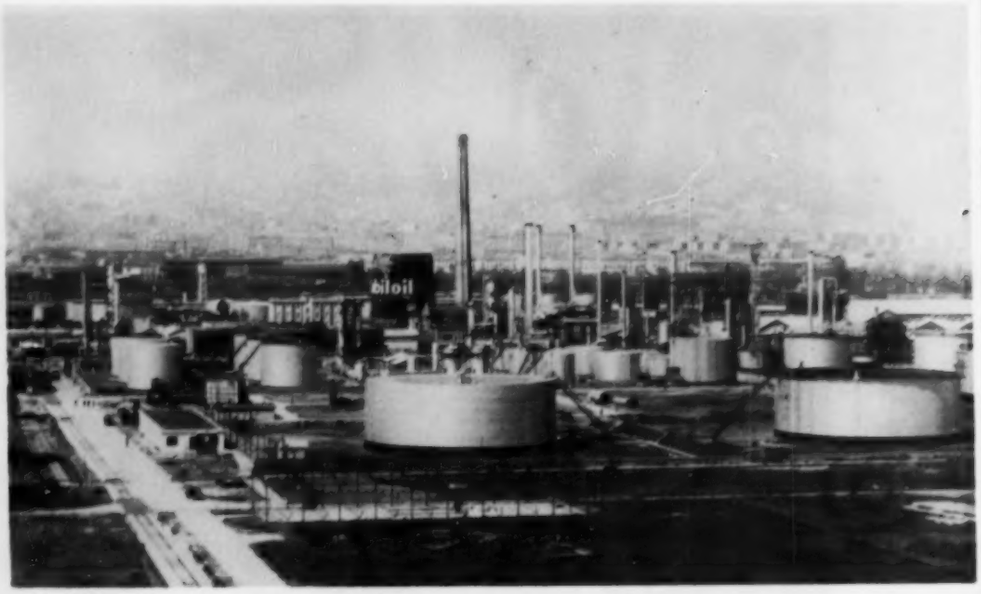
For this purpose the government, in conjunction with the Societa Montecatini, formed the ANIC (Azienda Nazionale per la Idrogenazione dei Combustibili). Two large refineries were built, at Bari and Leghorn, which started operation in 1938 with yearly output of 100,000 tons of automotive gasoline and 140,000 tons of aviation gasoline.

Its geographic location made the Bari refinery obviously most suitable for processing only Albanian crude, while the Leghorn plant also processed large quantities of low-grade crudes, mostly Mexican, through a cycle which comprised catalytic hydrogenation.

The Leghorn refinery was equipped with a large unit for producing lubricating oils and paraffin waxes from suitable imported crudes (Austrian, Hungarian, Romanian). In this refinery, up-to-date solvent extraction processes (Duo-Sol and Barisol) had been adopted, as well as refining with hydrogen. Other modern catalytic processes, such as alkylation, were installed by ANIC. The Aquila refinery at Trieste adopted extraction with SO_2 (Edeleanu) for its lubricants refining, while at Naples one of the first Houdry catalytic cracking plants was put into operation.

It may rightly be said, therefore, that at the outbreak of World War II, Italy had the most up-to-date and efficient refining industry in Europe, with a total of 17 plants, large and small, and an over-all yearly processing capacity of two million tons (more than 40,000 b/d). In 1938 these refineries had operated to the extent of 81-82 percent of their capacity, processing more than 32,000 b/d of crude and taking advantage of the most progressive technical processes then available. At that time Italy had accompanied the refining industry's development with the construction of a fine fleet of tankers, whose tonnage and efficiency gave it a place among the best.

World War II practically wiped out the Italian refining industry. Up to 1941 the air offensive had not caused a serious cut in the production potential of the various refineries, but intensified bombing in 1942 and 1943, followed by the invasion and dismantling of some plants, led to wholesale destruction. The Italian refineries, which had processed in 1941 a total of 1,400,000 tons of crude (mostly from Albania and Central Europe) were completely idle at the end of the hostilities in May 1945. The only exceptions were the Bari refinery, completely intact, which resumed operations as early as the autumn of 1943 for the Allied forces, and a few small plants in northern Italy.

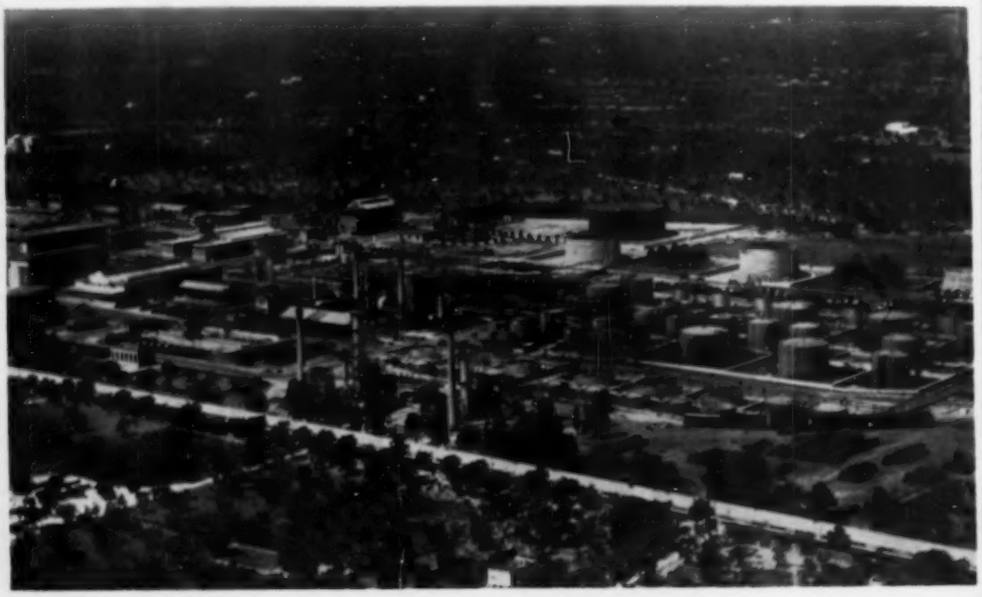


General view of the Naples refinery of Socony-Vacuum Italiana.

Rehabilitation and reconstruction proceeded rapidly in the petroleum industry. Private and government enterprises, ERP credits, initiatives taken by Italian and foreign companies together, enabled the refineries in 1947 to reach very nearly the 1938 level. The old plants, modernized where no more radical action was needed, or entirely rebuilt where damage had been particularly grave, were soon joined by numerous large and small completely new ones, which in but a few years raised the Italian industry's production to a level never before achieved, the second largest in continental Europe.

War damages were estimated at 70 million "1947" dollars. Post-war investment in reconstruction and the erection

Panoramic view of the STANIC refinery at Bari.



of new plants can be evaluated at about 15 times that amount.

Of the many agreements reached between Italian and foreign companies concerning the reconstruction and potentiating of refineries, the following are worthy of particular note, both on account of their importance in the industry and the outstanding interests involved: ANIC-Standard Oil Co. (N.J.), setting up the Societa Stanic to operate the modernized Bari refinery, and the completely rebuilt Leghorn refinery; AGIP-Anglo Iranian Oil Co., to operate the Porto Marghera refinery; and FIAT-Caltex, setting up SARPOM and Petrolcaltex, the former to build and operate the big new refinery at Trecate (Novara). the second to distribute products throughout the country. Other big international groups also have a part today in the Italian refining industry, such as Purfina, which has taken over the assets of the Italian companies Permolio and Galletti, with four refineries, small and medium-sized and the Compagnie Francaise de Petrole (partner in the ICIP refinery at Mantua).

The crude processed by Italian refineries has risen from 2.2 million tons in 1948 to 3.9 in 1949, 5.5 in 1950, 7.5 in 1951, 9.9 in 1952, 12.8 in 1953 and 16.7 in 1954. As early as 1949 the industry began exporting large quantities of finished products.

The accompanying table shows the quantity of processed crude and of finished products from Italian refineries in 1953 and 1954. Refining activity in the years considered above has been devoted almost equally to the domestic market and to exports. An exception is residual fuel oil (7,221,103 tons), which has been mainly absorbed by internal demand, about 5,000,0000 tons, plus 500,000 tons directly imported.

The greater refining capacity and the construction of large refineries on the seashore, and inland plants with pipelines running down to the sea, has led to a notable increase in petroleum traffic in many Italian ports. Savona, Ancona and Augusta, once negligible from the point of view of mineral oil cargoes, have become important petroleum ports. In other ports, like Genoa, petroleum cargoes have beaten the record both in tonnage and in percent of the total traffic of merchandise loaded and unloaded. Imports of oil began to affect receipts of coal in 1952 (9.2 against 7.8 million tons) and the trend has since been emphasized. Oil movements are presently in first place among goods and merchandises entering and leaving Italy.

DELIVERIES OF OIL (CRUDE & PRODUCTS) AT MAIN ITALIAN PORTS (1954)

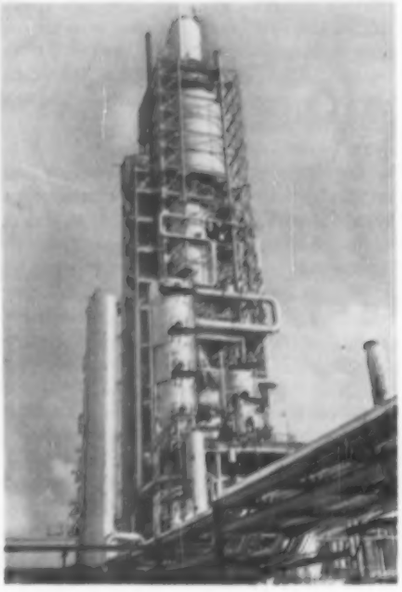
PORT	METRIC TONS	% OF TOTAL DELIVERIES
Genoa	3,380,230	41
Naples	3,318,784	67
Venice	2,261,596	50
Leghorn	1,968,670	70
Bari	1,614,914	92
La Spezia	1,527,467	70
Ancona	876,141	78
Savona	868,890	27
Trieste	862,515	33
Augusta ..... (Estimated)	1,800,000	—

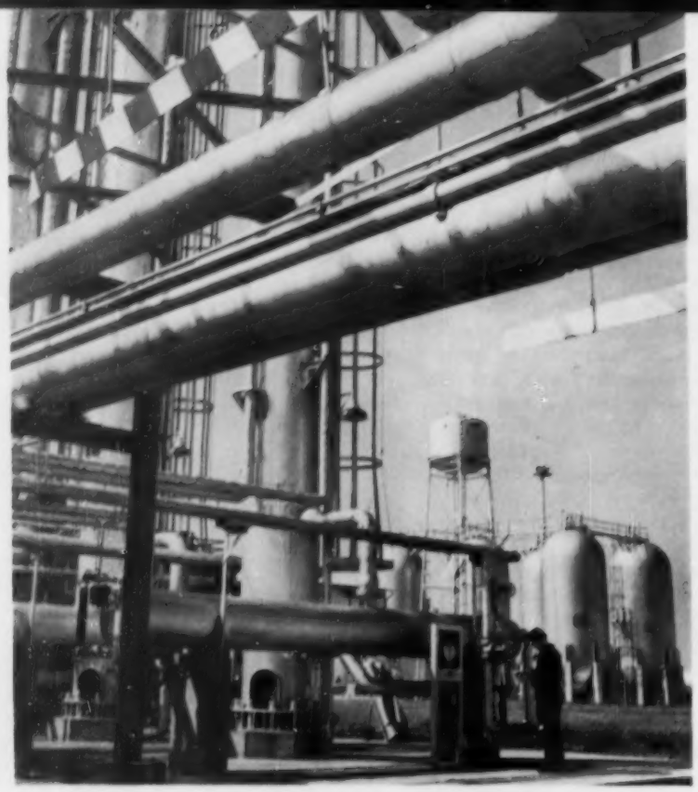
With the inception of OEEC, the Italian petroleum economy should have been

Distilling unit Number I at the INPET refinery (Shell), La Spezia.

View of the IROM refinery at Porto Marghera.

TCC unit at the Condor refinery, Rho.





Gasoline recovery plant operated by AGIP-Mineraria at Cortemaggiore.

OVERALL PRODUCTION OF ITALIAN REFINERIES (METRIC TONS) IN 1953 AND 1954

	1953	1954	Increases — Tons	Increases — Percent
Crude processed	12,842,871	16,168,641	3,325,770	+25.90
Gasoline	2,286,682	2,805,269	518,175	+22.68
Kerosine & jet fuel	818,714	1,027,889	209,175	+25.55
Gas and diesel oil	2,483,695	3,155,584	671,889	+27.05
Residual fuel	5,792,527	7,221,103	1,428,576	+24.66
Lubricants	99,394	131,465	32,071	+32.27
Bitumens	319,104	400,889	81,785	+25.63
LP-Gas	111,102	200,606	89,504	+80.56
Refinery consumption and loss	931,653	1,225,836	.....	....

AVERAGE TAXATION OF REGULAR GASOLINE AS A PERCENTAGE OF UNTAXED SELLING PRICE

Country	1954 Tax
Belgium	157
France	233
Germany (West)	93
Netherlands	104
United Kingdom	162
Switzerland	70
Italy	235
U. S. A.	28

integrated with that of Western Europe, and refining capacity was intended to cover the internal demand and to supply limited exports within the Mediterranean area and to central Europe. Execution of this program, however, did not have much success. In Italy, the government took a rather liberal attitude toward the expansion of refinery capacity and it has grown to represent about three times the internal consumption.

However, favored by geographical location and various circumstances, the Italian industry has operated at a rather high rate of plant utilization, owing to large exports of finished products.

The tax burden on products to be sold in the country is such as to favor a processing pattern comprising a substantial production of heavy fuels, and renders difficult the adoption of more technically sound and economically convenient operations. Notwithstanding this fact, as well as the existence of several nearly obsolescent refineries, the quality of products marketed in Italy is rather high by European standards. Gasoline of 82-84 research octane (regular grade) and of 90-92 (premium grade) is sold at most filling stations.

New loading pier at the RASIOM refinery, Augusta, Sicily.

Natural gas conversion reactors at the Montecatini works at Ferrara.

ITALY'S HYDROCARBON INDUSTRY

Part III: The petrochemical industry

ITALIAN SCIENTISTS and technologists have long been interested in the chemical utilization of natural gas. Research has been conducted since the early thirties by the Stazione Sperimentale per i Combustibili on different chemical utilizations, among them the conversion of CH_4 to $CO+H_2$ mixtures, chlorination, sulfurization, synthesis of methanol and high temperature cracking to aromatics.

Unfortunately, the industrial exploitation of natural gas as a raw material for the chemical industry formerly was retarded by the scarcity of available gas. Only in the past ten years, the discovery of substantial gas deposits in northern Italy, in the very center of the country's chemical industries, and the rapid expansion of an efficient pipe line system, have given the chemical industry a real incentive to use gas for synthesis of chemicals.

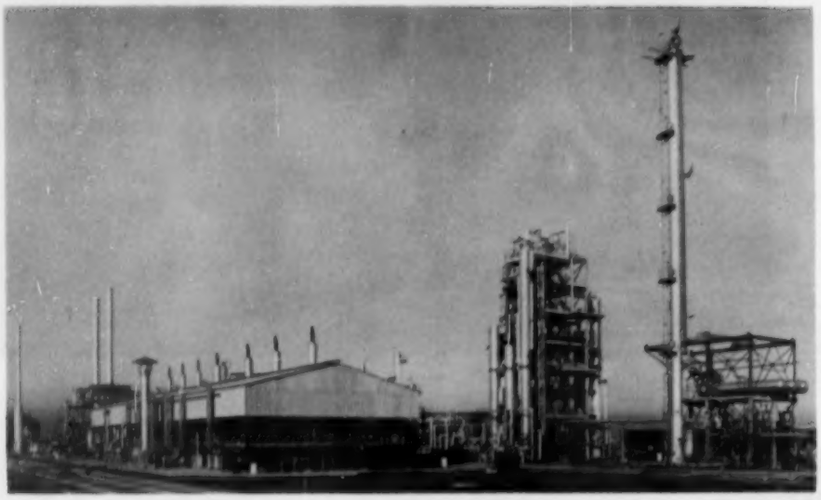
The lack of coal and oil resources in Italy, with the consequent necessity of depending on imports in this field, has been a further inducement toward the establishment of a petrochemical industry based on natural gas.

A number of projects for the chemical utilization of natural gas have been put in operation in recent years, while more are planned or under way. Original contributions to the development of processes which have successfully entered the commercial field have been developed by the research department of the leading Italian chemical company, Montecatini.

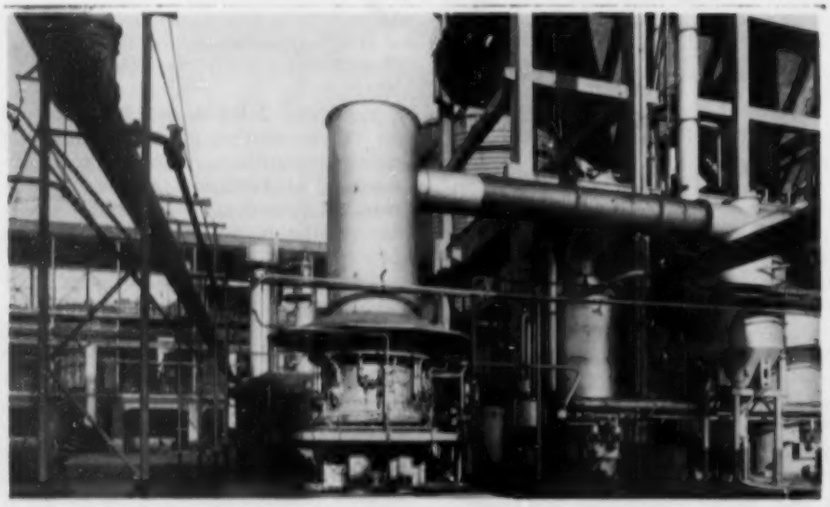
Particular interest has been focused on the production of ammonia and of nitrogen fertilizers, since their importance is predominant for the development of agriculture in a country where overpopulation poses problems difficult of solution.

Montecatini presently has two large plants operating in the synthesis of ammonia and related chemicals (nitric acid, nitrogen fertilizers, urea) starting from natural gas from the Po valley fields. Before entering the commercial field, Montecatini carried out an extended program of study and development work, particularly on the ammonia synthesis, at their research center "G. Donegani" at Novara. The first European industrial plant for ammonia synthesis from natural

Air view of the Ferrara hydrocarbon works.



Cracking and fractionating plant for ethylene production at the Montecatini Ferrara works.



Montecatini plant for production of hydrogen from fuel oil at S. Giuseppe di Cairo.

gas was erected at Diciosanmartin, Romania, on Montecatini - Fauser patents about 20 years ago. The operating pattern of the two Montecatini plants presently operating in Italy, at Novara and Ferrara, comprises the conversion of methane, with the production of ammonia, urea, nitric acid, ammonium nitrate, ammonium sulfate, and methanol. Synthetic methanol, which is presently produced almost exclusively by Montecatini, comes entirely from natural gas operations.

Nitrogen fixation capacity of the Montecatini plants is above 35,000 metric tons a year at Novara, and about 50,000 tons at Ferrara. The latter plant is part of an integrated petrochemical factory which includes facilities for the production of chemicals from imported crude.

Minor plants for the production of ammonia from natural gas are operated by Rumianca S.p.A., a chemical company, at Pieve Vergonte, Novara, and by Vetrocoke S.p.A. at Porto Marghera, Venice. The first unit operates on the C.C.C. process, the second one on the Hercules Powder process. Both processes, developed in the United States, produce hydrogen by the endothermic reaction of methane and steam, on nickel catalyst, in refractory steel tubes, externally heated.

The autothermic process, or the incomplete oxidation of methane with oxygen, generated in a Frankl-Linde unit, is employed by Montecatini. Such a unit allows oxygen production at a relatively low price. Owing to the rather low pressures at which 95 percent of the air is compressed, and to the efficiency of water and carbon dioxide separation, the overall energy requirement is about 0.6 kwh per cubic meter of oxygen produced.

The partial oxidation of methane with oxygen, in the Montecatini-Fauser process, is carried out on nickel catalyst, in one single stage at relatively low temperature (750-800° C). Conversion yields are of 2.8 cubic feet of H_2+CO mixture containing less than 0.2 percent unreacted methane, starting from one cubic foot methane and 0.6 cubic foot oxygen. The high yield is reached through accurate heat exchange and highest possible heat recovery, which permit introduction in the converter of the reactant gases (CH_4, air, O_2, and steam) preheated at a rather high temperature, and production of the steam necessary to the process. Further steps in the utilization of methane conversion products at the Montecatini works are carried out on Fauser processes (ammonia, nitric acid, urea).

The production of urea has been studied by Montecatini since the early thirties. Improvements have been made in this process, which is known throughout the world and is in operation in several commercial plants, some of which are in the United States.

Catalytic oxidation of methane to $CO+H_2$ represents in Italy by far the largest chemical utilization of natural

gas. This process absorbs about three quarters of the natural gas used for chemical purposes.

The recent expansion of domestic production of nitrogen fertilizers will greatly benefit Italian agriculture. Domestic production of fertilizers has been brought to a level which covers the internal market requirements, and allows for substantial export. Costs of fertilizers, thanks to the use of natural gas for their production, are presently rather low in Italy and prices in Italy are also rather low, as is shown in the following table*.

PRICES OF NITROGEN FERTILIZERS IN DIFFERENT COUNTRIES
(1954 Italian Lire per kg of Nitrogen)

	NH_4 SULFATE	NH_4 NITRATE
U.S.A.	167-180	160
Italy	147-167	134-151
France	210-238	165-185
West Germany	155-171	160-175
Netherlands ..	137-146	133-145

Autothermic cracking by partial combustion of methane with oxygen is also presently applied on a commercial scale in Italy for the production of acetylene and acetic derivatives. The Sachsse-BASF process was first applied in commercial operations (1952) in the U. S., at the Monsanto works in Texas City, and in Italy at the Edison works in Porto Marghera, Venice and at the SISAS plant near Milan.

The Sachsse process can be considered as economically competitive with the calcium carbide process, provided a convenient use for residual gases can be found. For the production of one pound of acetylene, the following constituents are reported by the BASF: hydrocarbons (methane), 4.3 lbs.; oxygen, 4.9 lbs.; solvent, 0.004 lbs.; low-pressure steam, 4.0 lbs.; and electric energy, 0.75-1.00 kwh. With the production of one pound of acetylene about 150 cubic feet of lean gas are obtained. If the latter is used for electric power generation and for steam rising, considerably more energy can be gained than is used for acetylene production. At the Edison works, where natural gas is also employed for the production of halogenated solvents, acetylene is mainly used as raw material for polyvinyl-chloride plastics, while the SISAS plant is mainly devoted to the production of acetic derivatives. Montecatini is also operating a pilot plant for the production of acetylene, under a process of their own, at the Novara works.

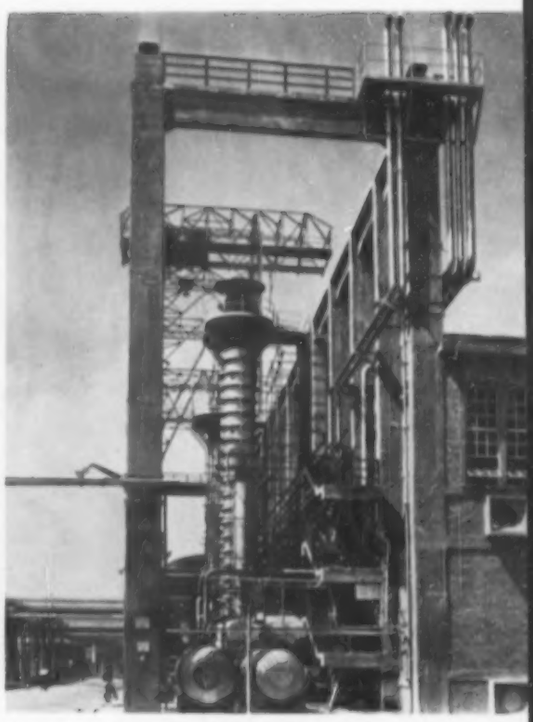
Besides the above processes, based on the partial oxidation or combustion of natural gas (synthesis of nitrogen fertilizers, methyl alcohol, acetylene), many other chemical uses of methane are being introduced or studied in Italy including the production of halogenated compounds, of carbon disulfide, hydrogen cyanide and others. New plans foresee the erection of facilities for the production of synthetic rubber and polymers, beside plants for ammonia and acetylene. The government-controlled ENI recently contracted with Carbon and Carbide for the erection at Ravenna, in the eastern Po valley, of an integrated plant for chemical utilization of natural gas recently discovered in the area. The plant will employ autothermic cracking to produce acetylene, which will be transformed into synthetic rubber. From residual gases, hydrogen and ammonia (and nitrogen fertilizers) will be produced. The plant, which will be operated by the ENI subsidiary ANIC, will have a capacity of 33,000 tons a year of synthetic rubber (GR-S) and 385,000 tons of nitrogen fertilizers, with a consumption of about one million cubic meters of natural gas per day.

Besides the production of chemicals from domestic natural gas, there is presently in Italy one large plant for the production of chemicals from imported crude. The plant is part of the Montecatini works at Ferrara, which are subdivided into the "Azoto" section (ammonia and fertilizers from natural gas) and the "Idrocarburi" section (chemicals from imported crude). Middle East crudes arrive at Ferrara by barge, from the marine terminal of Porto Marghera (Venice) via the Adriatic sea and the Po river.

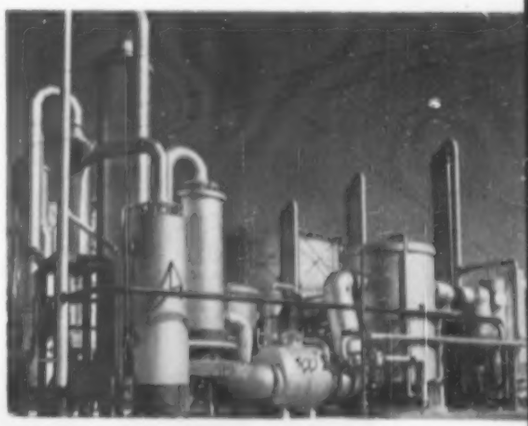
Crude is first distilled in a 4,500 b/d topping unit, and the topped crude is further treated in a visbreaker. The intermediate cuts (naphtha and gasoil) are the charge for the steam cracking unit (Kellogg) of a charge capacity close to 2,500 b/d. The operation is carried out at 650-750°C and low pressure, followed by quenching at 250°C in a boiler where by-product steam at 400 psia is recovered. The vapors pass to a prefractionator, where gas and light distillates are separated from the heavy bottoms. Overhead products are then fed to a 210 psia fractionating plant, where partially debutanized gasoline is withdrawn from the bottom, and the C_4 fraction is taken overhead. Overhead vapors are treated with diethanolamine and caustic solution for the elimination of sulfur compounds, dried on alumina, and passed on to the catalytic unit for the conversion-removal of acetylene. Gases from the acetylene converter are cooled and fed to a secondary depropanizer where butylene and heavier components are removed from the bottom, and light ends pass overhead. The further separation of different light components is carried out in a series of fractionators.

The plant capacity is of 56,000,000 pounds per year of ethylene C_2 olefins, which will be utilized for the following chemical products: polyethylene, polystyrene, ethylene oxide and glycols, ethyl chloride, dibromoethane, dichloroethane, propionic aldehyde and acid, isopropyl alcohol (and acetone), polymers, butyric and isobutyric aldehydes, and high-boiling alcohols for plasticizers.

*A. Mancinelli: Paper Presented at the 3rd National Convention on Natural Gas Utilization, Piacenza, September 1954.



Ammonia plant at the Montecatini works at Novara. CO_2 absorption tower.



Methane cracking and conversion plant at the Montecatini Novara works.

Nitric acid plant at the Montecatini works at Novara.

View along the historic Appian Way.

State highway, Milan–Pavia, in the lower Po Valley.

The ancient (300 B.C.) Via Flaminia runs parallel to the modern Via Flaminia in some portions. This view is near Rome.

MOTOR ROADS IN ITALY

Winding ascent of the Cisa Pass road between Parma and La Spezia.

DEVELOPMENT of the motor car industry and the use of motor vehicles must be dependent to a degree upon the condition of the highways provided for surface travel. Italy has no lack of delightful scenic views nor of places rich in historical association to lure visitors from other lands. She also has a good system of state roads linking up the larger cities, seaports and tourist resorts, but in some of the less developed agricultural districts there are still large areas served only by unimproved dirt roads.

The national highways of Italy, now designated as State Roads, are under the direction of a state-administered agency, the ANAS, established in 1928. Other highways are classed as Provincial Roads and Parish Roads and are supervised by the Ministry of Public Works through a special agency called the "Direzione Viabilita Ordinaria." The total mileage in each class is as follows:

	TOTAL MILEAGE	PERCENTAGE PAVED
State Roads	14,886,526	80
Provincial Roads .	24,098,505	24.18
Parish Roads	63,618,647	1.68
	102,603,678	Av. 18.34

To the above must be added about 200 miles of roads built in connection with the program of agricultural reform.

The average width of paved surfaces on main roads is about 20 feet and on many minor roads less than that. There is need for the relocation of many highways to eliminate sharp curves and corners, abolish grade crossings and overcome congestion on traffic routes. An aesthetic improvement that would appeal to visiting motorists would be removal from scenic routes of unsightly advertising signs and hoardings.

The diversity of highway conditions in Italy is in part a survival of the period before unification when the country was divided into a number of small kingdoms which varied greatly in resources and in their degree of interest in transportation problems. There is also the restriction imposed by the mountainous nature of the country, with the Alps and the Apennines forcing traffic to adhere to tortuous mountain passes in certain places.

During the past decade there has been the added burden of repairing the widespread destruction imposed by bombing during the war. By the end of that conflict, the damage to the highway system included not only the destruction of thousands of miles of paved surfacing but also the blowing up of bridges, tunnels, maintenance buildings and retaining walls. Plants were stripped of their machinery, hundreds of thousands of trees were cut down and communication lines were disrupted. For several years an average of $160 million was spent, divided fairly equally between new construction and maintenance, and by 1952 the worst of the war losses had been repaired.

Through the FIS (the Italian Road Federation) public opinion is being aroused to the need for further reconditioning of Italy's road system. The Minister of Public Works, Sr. Romita, is taking up an earlier project which proposed an expenditure of $1,440 million and has extended it to include provincial and parish roads with expenditure of $2,240 million over a period of ten to twelve years.

Along the Via Mostra, Bolzano, in the north of Italy near the Austrian border.

Italy's Mille Miglia auto race from Brescia around the Italian boot and back again to Brescia has long been a showcase not only of Italian cars, but of other European models as well. The 1955 race, below, was won by British driver Stirling Moss in a Mercedes-Benz.

The Italian Automobile Industry*

Fiat's Model 1100 is a good example of a low-priced family car.

ITALY ENTERED the automotive field behind the industrial countries of France, Germany, Great Britain and the United States. The reasons for her tardiness are obvious. Italy was mainly an agricultural country and had not come under the influence of the industrial revolution which spread over other parts of western Europe during the eighteenth century following the appearance of the steam engine.

When the motor vehicle arrived, Italy had to create an entirely new industrial structure in order to face the great problems raised by the advent of mechanical transportation. France, on the other hand, was a leader in the field with U. Cugnot's invention contributing to the first steam vehicle in 1769. In 1886 the first vehicle with an internal combustion engine was produced.

The subject appealed to Italians, however, and experimentation resulted in discoveries made by Barsanti and Matteucci in 1857, by De Cristoforis in the field of gas engines and by Luigi Pagani, Riva, Pecori and Bordino relating to work on motor vehicles.

In 1895 Michele Lanza, a Turinese, designed the first automobile built in the Piedmontese capital and in 1899 there was founded in Turin the first large automotive plant, employing about fifty men. This was the beginning of Fiat, a name that was destined to make itself known around the world. At the present time the company has about 40,000 employees and is one of the world's great motor works.

Between 1899 and 1907 other motor works sprang up in Turin: Itala, Lancia, Rapid, Diatto-Clement, Spa, Scat & Co.

During the same period, in Milan, a strong group of companies was formed among which were Isotta Fraschini, Bianchi, Ferera, Prinetti & Stucchi, Zuest and others and, later, Alfa Romeo.

Around these two important industrial centers other companies appeared, along with a number scattered over Italy, but most of these were short lived and had little influence on the economy of the country.

In time, Italian production achieved high quality and cars were widely exported.

A curve depicting the course of the Italian motor car industry would rise almost vertically between 1891 and 1908-1909, followed by a rapid decline in 1912-1913. The curve continues downward

*Prepared by Associazione Nazionale Fra Industrie Automobilistiche e Affine, through the courtesy of Petrocaltex.

The influence of Italian motor car styling is felt world-wide. This Fiat V-8 sport model, with an experimental plastic body, appeared at a recent salon only half varnished in order to show the underlying plastic material.

until 1918 when an upward trend is followed by another drop in 1924-1925, demonstrating that in two periods the Italians were guilty of overexpansion in the motor car industry by setting up a number of concerns far exceeding their possibilities of absorption and expansion.

The blow given to the economy of the nation by this lack of planning was serious but, on the other hand, the nation profited by the vitality of those companies with sound foundations which managed to meet requirements and survive in spite of the danger of a general collapse.

In 1953 the Italian motor industry built 174,308 vehicles (142,861 cars, 7,319 vans, 21,842 trucks, 2,286 buses). In the ten years preceding the last war the yearly average was about 50,000 vehicles, with a peak of 77,000 in 1937. The 1953 production figure reflects the effort made after the war by the motor card industry in rising from the low figure of 10,000 to which it had dropped in 1945 to the 43,-700 mark in 1947, 86,000 in 1949, 145,000 in 1951, 174,308 in 1953 and 104,208 for the first six months of 1954. The latter figure indicates a record figure of over 200,000 for the full year.

Export figures are also good: 31,506 motor vehicles were sent abroad in 1953, showing an increase of 19 percent compared with 1952. During the first six months of 1954 total exports amounted to 19,710 motor vehicles with an increase of 18.7 percent over the same period of 1953.

The chief markets abroad in order of importance are Sweden, Switzerland, Germany, Austria, Belgium, Spain, Holland and Denmark.

In this connection it may be pointed out that only recently have Italian motor vehicle manufacturers enjoyed assistance and advantages in their exports in the form of reductions in taxation, while automobile builders of many European countries have for some considerable time enjoyed these and other benefits granted by their respective governments.

The leading motor works in Italy now are: Fiat (Turin), Lancia (Turin), Alfa Romeo (Milan), O. M. (Brescia), and Bianchi (Milan). Smaller firms are: Ferrari (Modena), Siata (Turin), Maserati (Modena), and Moretti (Turin), builders of sports and special touring cars.

Technically speaking, Italian vehicles aim principally toward economy in running costs. Generally, cars are of the four cylinder model, with sixes and eights the exception. The main characteristics of Italian cars are overhead valves, high compression and high rpm.

Frames are all fitted with independent wheels (at least in the case of the front wheels), four speeds (in certain cases five-speed gear boxes), hydraulic brakes, good springing and comfortable steering. Trucks are generally fitted with diesel engines and are built in various types according to carrying capacity (light, medium and heavy).

The last motor show, held in Turin, was an outstanding success, demonstrating the capabilities of the leading Italian motor car manufacturers. The results obtained by Italian body-builders, even using American, British and French frames, must not be overlooked for it underlines the pre-eminent position they have attained in motor car styling.

The Italian automotive industry, taking advantage of technical progress, is constantly developing new models of cars and commercial vehicles.

Production is naturally not as large as that of the United States and Great Britain, but when compared to such giants, Italy holds her ground brilliantly. Quality of product, continuous efforts to bring plants up-to-date and the keenness and competence of the technicians are the best guarantees that the industry's future will be worthy of the brilliant traditions of its past.

The Italian capitol building at Rome.

ITALIAN hydrocarbon legislation

By Prof. Saverio Hardi
University of Rome

ITALIAN MINING LAW is going through a phase of evolution imposed by promising new developments in the exploration and exploitation of subsoil resources of the country.

The discovery of important quantities of natural gas in the Po Valley and oil horizons in Sicily and the Abruzzi, the need for developing these resources, the problems of hydrocarbon transport and the technology of gas utilization, are the aspects of a new phenomenology which call for a revision of applicable jurisprudence which is now under way.

Up to the present time these problems have been approached from the standpoint of the basic law No. 1443 of July 29, 1927, which is commonly known as the "mining law." But in the face of new developments in the Italian extractive industries, this document has been found deficient in many respects and in urgent need of reintegration.

The fundamentals of the law in question may be outlined as follows:

a) Abolition of previous regulations as inequitable.

b) Separation of ownership of the subsoil from ownership of the surface.

c) Reservation of underground deposits to the government as inalienable parts of the national patrimony.

d) Establishment of a system of permits for exploration in the form of concessions arranged between the government and private interests.

e) Freedom in all forms of scientific investigation.

The foregoing principles of the "mining law" were put into effect as follows:

1) Articles 4 and 14 forbade anyone to undertake exploration for minerals or their exploitation without first obtaining a permit and a concession from the authorities. These rights were declared nontransferable by article 826 of the civil code.

2) Permits ror exploration and concessions for exploitation were issued only to persons having the requisite technical and financial resources, and were limited to a fixed time.

3) The owner of the surface was forbidden to interfere with exploration, but had to be compensated for any incidental damage.

4) In matters of exploration, the permit holder was subjected to surveillance and control by the government.

5) When a deposit was discovered and its industrial importance ascertained, a concession was not necessarily issued to the discoverer, who was merely allowed preference if he had the requisite technical and financial qualifications.

6) Even during the exploitation phase, operations were still under technical control by the government.

7) Any default of the holder of the permit or the concessionaire could result in cancellation.

The first attempts to discover and drill for liquid and gaseous hydrocarbons were handicapped by these provisions of the mining law, and the necessity for a revision became manifest.

The lack of utility of the existing system was emphasized in the Ministerial Circular of October 20, 1937 on the "Discipline for Surveying for Hydrocarbons, Gases and Mineral Waters," which made evident the necessity of issuing new standards. Particularly pressing was the need to encourage exploration and to establish the principle of giving the discoverer a clear right (not merely a preference) to allocation of a concession for exploitation.

On the other hand, it was necessary to select the criteria for adoption in reforming the mining law. After a period of uncertainty it was decided to retain the fundamentals and to integrate them by the issuance of special regulations applying to exploration, exploitation and transport of liquid and gaseous hydrocarbons, revising and coordinating the various initiatives and governmental participation so as to eliminate harmful interferences and the overlapping of functions.

This latter objective was dealt with by promulgation of law No. 136 of February 10, 1953, which created the Ente Nazionale Idrocarburi (National Hydrocarbon Authority). The other two objectives remain to be concretized by two other proposed laws, one relating to exploration and exploitation and the other to the construction and operation of oil and gas pipe lines.

Establishment of the Ente Nazionale Idrocarburi was based on principles of the Constitution of Italy and the leading features of the mining law of 1937.

Article 43 of the Constitution establishes an important derogation of freedom of private initiative by declaring that "in the general interest, the law may reserve to the government, to public or communal entities, by means of expropriation with indemnification, for operation or use, any category or categories of enterprises that involve essential services or sources of energy, and may monopolize situations affected by a permanent general interest."

In discriminating between governmental intervention and the freedom of private enterprise (which certainly includes problems of policy relating to the discovery and utilization of hydrocarbons), the Constitution sanctions the principle that the action of the state or the participation of the state in enterprises is fully legitimate, under the con-

dition that such activity has a character of public utility or is of preeminent collective interest, but is totally excluded where such collective interest is altogether absent.

To this it may be added that on the basis of article 826 of the Civil Code, minerals form a part of the inalienable patrimony of the state, which may concede to private parties the right to explore for and to utilize them. Moreover, when the state has the intention to enter directly into exploration, it may choose the zone of exploration, which will be defined by an appropriate ministerial decree. That is to say, under the law, the state, by virtue of its ownership of the products of the subsoil, has a paramount right of preference for undertaking exploratory activities. Therefore, the state, in exercising the right to explore "ex lege" in the matter of finding minerals, in common with any other holder of a permit for exploration and in accordance with article 16 of the mining law, has a preferred right to exploit the deposit. This naturally enables the state to act directly through agencies of its own creation or through organizations in which it has a preponderant interest. For exercising the latter right the government has created the AGIP in the form of a stock company with participation of public funds, and to it has assigned the task of carrying out geological research and mechanical explorations with the object of finding and developing oil and gas deposits.

However, due to recent discoveries, there have been opened new perspectives in exploration and exploitation of hydrocarbons and natural steam, and a need has arisen for an organic coordination of all sources of energy and especially as regards their distribution. It has been deemed possible to meet this need by a literal construction of article 43 of the Constitution, which allows the state to pick the zones for its direct operations while leaving other zones open to private operation under state control. It has thus been decided to invest the Ente Nazionale Idrocarburi with sole responsibility for exploration, exploitation and transport of hydrocarbons and natural steam in the region of the Po Valley, wherein the state has already made heavy investments over a period of years, and to throw the rest of the national territory open to concessions managed by stock companies in which the state and private investors may have a part and which may issue obligations under government guarantee.

In pursuance of this idea, the government has prepared for submission to Parliament a prospective law for regulation of oil prospecting outside the Po Valley. The main features of this proposed law are as follows:

a) Permits for exploration will be issued to applicants who have satisfactory technical and financial qualifications, but no one person may acquire an exploration permit covering an area of more than 50,000 hectares (123,500 acres). Groups of persons or an incorporated company may receive permits for up to a total of 300,000 hectares, with not more than 150,000 of these hectares in a single area.

b) The duration of the permit will be three years, subject to two extensions of two years each, provided that the obligations attached to the first permit have been fulfilled. If a permit holder has made a discovery on a part of his area, he may have an additional extension for the rest of his territory.

Holders of exploration permits are required to initiate prospecting within a period not exceeding six months from the date of the permit, and to begin drilling within 18 months from that date.

c) A permit holder must meet the conditions imposed by the granting authority and for the first two years must pay, in advance, 100 lire for each hectare in his area; during the first two-year extension of the permit the annual payment per hectare will be 200 lire and during the second extension, 300 lire. The proposed law affirms the principle that a permit holder who makes a discovery in his area and has fulfilled all obligations is entitled to a concession for exploiting the liquid or gaseous hydrocarbons he has found, subject to approval by the Superior Council of Mines. Duration of such concessions will be 20 years, with two possible 10-year extensions.

The concessionaire must conform to general rules for the rational exploitation of the formation with particular regard to the production of gas so as not to prejudice the future production of liquid hydrocarbons. He must pay to the government a standing annual charge of 1,000 lire for each hectare of his concession, plus an annual royalty commensurate with his effective production and the market price of the product.

Another provision of the proposed law is that within the same area covered by a permit or concession, permits and concessions may be given to other parties, but for different depths of drilling. This provision covers the case where the first holder is unwilling or does not have financial resources for carrying his drilling operations to lower horizons.

It is possible that during the coming discussion in Parliament this provision, among others, will be subject to modification, and moves probably will be made to reduce the area of exploitation in relation to the area of exploration and to impose higher royalties. However, the situation is still fluid and no objective conclusion can yet be drawn.

The problem of regulating the modern system of transport of oil and gas in pipe lines has not yet been covered by legislative action, notwithstanding the enormous increase of production and consumption of gas for industrial uses and domestic heating. Four years ago there was presented to the House of Deputies a project of law entitled "Construction and Operation of Oil and Gas Pipe Lines," but this proposition somehow aborted. It may nevertheless be useful to note its content as an illustration of the manner in which this problem has been approached. It was proposed that the right to construct and operate oil and gas pipe lines, and all accessory works, should be subject to administrative concession. Such concessions were not to be granted for periods longer than 50 years, though they might be extended; on termination of the concession the pipe line and subsidiary works would revert to the state. The holder of a pipe line concession had the right to occupy a prescribed zone with means and materials, and to place the necessary facilities under, on, and above the surface and have full liberty of access for the passage of service and maintenance personnel. In other words, pipe lines were to be declared public utilities, and their sponsors were to have the right to expropriate the necessary terrain on application to the Minister of Industry, who would fix the amount of indemnity to be paid to the previous occupants. The right of expropriation would extend to property owned by the state or local municipalities. The pipe-line concessionaires would make an annual payment to the state in proportion to the length of the line and the square of its diameter.

To conclude this summary of Italian hydrocarbon legislation, notice may be taken of the Sicilian regional law No. 30 of March 20, 1950 for regulating exploration for and exploitation of hydrocarbons in that province, which was passed and is administered by the provincial government. According to this regional law, permits for exploration are issued by decree of the Assessor of Industry and Commerce and may run for three years with two possible extensions of three years each. However, the area covered in the original permit is reduced by 20 percent for the first extension and by 30 percent for the second extension. The area covered by a single permit will not exceed 100,000 hectares. The holder of a Sicilian permit has the right to a concession to exploit any deposit which he has discovered in his area. A Sicilian exploitation concession has a duration of 20, but may not exceed 30 years. The royalty to be paid is fixed by the terms of the concession. The Sicilian law provides for regulating the construction and operation of pipe lines for transporting and distributing the product. In case the concessions for hydrocarbon production and for transport by pipe lines are held by different interests, the two parties, under supervision of the Assessor of Commerce and Industry, will work out a program of cooperation advantageous to both. The Sicilian law limits the indemnity to be paid the owners of the land condemned for the pipe line to an amount representing the depreciation of the value of their property.

WORLD SUPPLY POSITION

WESTERN HEMISPHERE

	1954	1953
Domestic Supply	9,764	9,649
Domestic Cons.	9,391	9,193
Surp. or Short.	+373	+456
Supply Incr. %	1.2	
Cons. Incr. %	2.2	

EASTERN HEMISPHERE

	1954	1953
Domestic Supply	4,726	4,244
Domestic Cons.	5,009	4,388
Surp. or Short.	—283	—144
Supply Incr. %	11.4	
Cons. Incr. %	14.2	

WORLD

	1954	1953
Domestic Supply	14,490	13,893
Domestic Cons.	14,400	13,581
Surp. or Short.	+90	+312
Supply Incr. %	4.3	
Cons. Incr. %	6.0	

WORLD'S OIL SUPPLY AND DEMAND
(From Government and Private Sources)
Year 1954 — 1,000 Barrels Daily

Area and Principal Countries	Crude Prod.	Nat. Gaso. Etc.	Total Imports	Total Exports	Ref. Runs	Dom. Cons.	Dom. Supply	Surplus or Short
NORTH AMERICA	6,838	689	1,407	423	7,624	8,526	7,527	— 999
U. S.	6,346	681	1,052	356	6,958	7,752	7,027	— 725
Canada	263	4	307	9	463	557	267	— 290
Mexico	229	4	31	58	203	201	233	+ 32
Other	...	...	17	...	...	16	...	— 16
CARIBB. — WEST INDIES	...	2	774	744	739	177	2	— 175
CENTRAL AMERICA	...	...	37	6	...	31	...	— 31
SOUTH AMERICA	2,218	17	429	1,986	800	657	2,235	+1,578
Venezuela	1,896	5	3	1,800	441	106	1,901	+1,795
Colombia	109	3	15	84	29	41	112	+ 71
Argentina	81	...	124	1	153	206	81	— 125
Trinidad	65	3	56	79	95	32	68	+ 36
Brazil	3	2	164	...	6	161	5	— 156
Other	64	4	47	22	76	111	68	— 43
WEST EUROPE	90	31	2,544	671	1,932	1,962	121	—1,841
United Kingdom	1	11	706	156	575	538	12	— 526
W. Germany	51	8	162	14	171	204	59	— 145
France	14	3	483	121	477	357	17	— 340
Italy	1	1	332	127	325	214	2	— 212
Other	23	8	861	253	384	649	31	— 618
MIDDLE EAST	2,738	...	1,143	3,571	584	298	2,738	+2,440
Saudi Arabia	953	...	...	908	219	48	953	+ 905
Iraq	627	...	3	605	17	23	627	+ 604
Iran	59	...	1	28	48	31	59	+ 28
Bahrain	30	...	184	180	214	36	30	— 6
Other	1,069	...	955	1,850	86	160	1,069	+ 909
AFRICA	39	2	339	...	89	379	41	— 338
Egypt	37	...	60	...	46	96	37	— 59
Union of So. Africa	...	2	71	...	14	72	2	— 70
Other	2	...	208	...	29	211	2	— 209
FAR EAST	351	5	647	248	456	741	356	— 385
Indonesia-Borneo	331	2	...	248	251	86	333	+ 247
Japan	6	...	176	...	130	179	6	— 173
India	6	3	87	...	15	92	9	— 83
Other	8	...	384	...	60	384	8	— 376
RUSSIAN CONTROL	1,386	84	158	254	1,336	1,350	1,470	+ 120
Russia	1,142	32	114	114	1,098	1,150	1,174	+ 24
E. Europe	238	52	...	140	236	150	290	+ 140
Other	6	...	44	...	2	50	6	— 44
IN TRANSIT, MILITARY, Etc.	...	...	425	...	...	279	...	— 279
WORLD TOTAL	13,660	830	7,903	7,903	13,560	14,400	14,490	+ 90
YEAR 1953	13,097	796	5,155	5,155	12,813	13,581	13,893	+ 312

This is a summary of a more detailed report on the world supply and demand outlook, which will be presented in the Second Edition of the WORLD PETROLEUM STATISTICAL YEARBOOK. Mr. Struth is collecting and assembling a vast amount of operating data on all branches of the industry, which will make the next edition of the Yearbook the most valuable compilation of its kind ever published.

improved in 1954

By H. J. Struth*

DESPITE the expansion of the world's oil supply sources, which contributed 4.3 percent more production last year, the growth in demand proved to be highly favorable in correcting the top-heavy supply picture of 1953. Preliminary results for the year 1954 indicate that the world's surplus oil supply amounted to only 90,000 barrels daily, compared with a surplus supply in 1953 of 312,000 barrels daily.

Demand for petroleum and its products increased last year by six percent, while the world supply increased 4.3 percent over the year 1953. Demand averaged 14,400,000 barrels daily, compared with the 1953 demand of 13,581,000 barrels daily. Production of crude oil and other liquids aggregated 14,490,000 barrels daily, against 13,893,000 barrels daily in 1953. Refineries of the world processed 13,560,000 barrels of crude oil daily, compared with a daily average in 1953 of 12,813,000 barrels.

The growth in demand for oil outside of the United States was marked last year by a net gain over 1953 of 11.7 percent, while demand in the United States increased only 1.9 percent. Consumption in the United States this year is expected to show substantial improvement, however, with the likelihood that demand will increase about five percent over 1954. This, coupled with continued gains expected in other parts of the world, presents a highly encouraging picture for the year 1955. In fact, it appears at this time that the world demand for oil during 1955 will perhaps reach some 15,500,000 barrels daily. This should allay apprehension as to the growth of supply sources which are being expanded in many parts of the world, particularly in the Middle East.

Surplus supplies were available last year in South America, the Middle East and countries under Russian control. These aggregated 4,138,000 barrels daily. However, all other areas of the world were short of supplies to the extent of 4,048,000 barrels daily, leaving an excess supply of only 90,000 barrels daily. Major markets for the world's growing oil output are the United States, Canada, Argentina, Brazil, Western Europe, Africa and parts of Oceania and the Far East. These areas were short of supply last year to the extent of some 3,860,000 barrels daily. While there was a shortage of supply in the United States of 725,000 barrels daily, it should be noted that domestic crude production was reduced by about 112,000 barrels daily, through efforts of state regulatory authorities to reduce stocks. Imports averaged 1,052,000 barrels daily, against 1,050,000 barrels imported in 1953. Any view of the future outlook, however, makes it evident that growing oil requirements will continue to provide expanding markets for surplus supply countries, in the United States as well as other parts of the world.

Since 1950, oil production in the Middle East has increased 56 percent, or nearly one million barrels daily. Meanwhile, production of the rest of the world has increased 26 percent. The availability of growing supplies in the Middle East appears less formidable today, however, in the light of constantly expanding world markets for oil. Some countries that heretofore have barred outside private capital for the development of their oil resources are recognizing the benefits that have accrued where the cooperation of private enterprise has been invited. The United States, Canada, Venezuela, Colombia and a number of Middle East nations, such as Saudi Arabia, Iraq and Kuwait, provide conspicuous examples of these benefits. Discoveries of new oil fields in France, Italy, and Sicily have introduced new thinking on this matter, perhaps opening the way to uncovering more hidden wealth in these and other nations.

The world is awakening to the realization that nations and their peoples have much better things in store for the future. As the economic well-being of millions is improved throughout the world, there will follow new, profitable markets for many commodities and particularly for petroleum and its products. The future outlook for the petroleum industry throughout the world presents an extremely favorable picture, as evidenced by the continued growth of demand.

*Editor, WORLD PETROLEUM STATISTICAL YEARBOOK.

Thomas Dewhurst

James Kewley

History of the World

By E. Lawson Lomax

Dr. A. E. Dunstan

Col. Louis Pineau

Jonkheer O. C. A. van Lidth de Jeude

Dr. A. A. G. Schieferdecker

INTERNATIONAL GATHERINGS of petroleum technologists and others interested in the industry took place at various times in the early part of the present century, extending back to 1900 when a meeting was held in Paris under the Presidency of M. Lesueur. Other group meetings were held at Liege in 1905 and at Bucharest in 1907. At the International Mining Exhibition held in London in 1923, an oil conference was arranged by the Institution of Petroleum Technologists at which papers were presented by A. Beeby Thompson and Cunningham Craig of Great Britain, Prof. R. d'Andrimont of Belgium and Dr. M. Krans and Dr. J. P. Voiteste of Romania. It was from this small beginning that the organization of a world congress stemmed.

The idea took definite form in 1933 when an international oil industries exhibition was planned for London and the Institution of Petroleum Technologists decided to hold a congress of technical members of the industry at the same time. A committee was appointed by the Institution to make plans for the meeting. This committee consisted of James Kewley, past president of the Institution, and Thomas Dewhurst, its ruling president, assisted by Lt.-Col. S. M. J. Auld, Prof. J. S. S. Brame, A. W. Nash, V. C. Illing, Dr. A. E. Dunstan, T. M. Garner, F. B. Thole, A. Wade, Ashley Carter, Christopher Dalley, A. W. Westlake, B. J. Ellis, J. McConnell Saunders, George Sell, F. C. Sterling of the government's petroleum department, and E. G. T. Thorne. Commander R. E. Stokes-Rees and George Sell were made joint secretaries.

It was at this meeting that the designation World Petroleum Congress was adopted and that the plan of having subsequent congresses at more or less frequent intervals was definitely established. While the organizing committee was made up entirely of Britons, the cooperation of outside organizations was invited. The American Petroleum Institute and the American Society for Testing Materials sent representatives to attend and the

Petroleum Congress

International Standards Association arranged to hold a meeting in London at the time of the petroleum gathering. Other societies which associated themselves with the oil conference were the World Power Conference, British Standards Association, National Lubricating Oil and Grease Federation, Institute of Fuel, Union Internationale de Chimie, International Petroleum Commission, and the German Society for Petroleum Research.

The British government gave the Congress official recognition, and under the presidency of Mr. Dewhurst and the vice presidency of Mr. Kewley, leading figures in government and in the petroleum industry were appointed honorary presidents. The list included Sir John Simon, Foreign Secretary; Sir Philip Cunliffe-Lister, Colonial Secretary; Walter Runciman, president of the Board of Trade; and Ernest Brown, Secretary for Mines.

The following prominent members of the petroleum industry were named as honorary vice presidents: Viscount Bearstead, Lord Greenway of Stanbridge Earls, Lord Wakefield of Hythe, Sir John Cargill, Sir John Cadman, Col. Louis Pineau of France and Prof. L. Ubbelohde representing Germany.

The committee in charge of the Congress program decided that its technical discussions should be conducted in four sections under the headings of Geological, Production Engineering, Refining and Chemical Engineering, and Standardization. Members of the committee were appointed to take charge of each of these sections and to handle the papers submitted.

The Congress was attended by 1,250 members, including official delegates from 23 countries, and some 250 papers were presented at the four sections. In addition, two important lectures were delivered, one by J. B Aug. Kessler on *Rationalization in the Petroleum Industry* and the other by Sir John Cadman on *Science in the Petroleum Industry*. Activities on the social side included an official banquet at the Mayfair Hotel, receptions by various companies and societies, excursions to interesting places and visits to various manufacturing plants.

Much of the credit for the success of the technical activities of the London Congress was due to the dynamic personality and energetic drive of Dr. A. E. Dunstan of the research division of Anglo-Iranian Oil Co., both in the shaping of the program and in the proceedings of the Congress. His insistence upon the importance of standardization gave impetus to that movement which has continued to be a special concern of the Congress in subsequent meetings. Others who contributed greatly to shaping the Congress were Mr. Kewley and Mr. Dewhurst. The latter has continued his active participation in the Congress down to the present time.

At the closing session of the Congress, a résumé of its work was made, with special reference to the advances which had been made toward international cooperation in petroleum standardization. Arrangements were made for the holding of the second Congress three years later at a location to be decided on.

It was decided in December 1936 by the executive committee of the first Congress that the second meeting should be held in Paris, June 14-19, 1937, under the auspices of the Association Francaise des Techniciens du Petrole (AFTP). At the invitation of the executive committee, Colonel Louis Pineau, director of the Office National des Combustibles Liquides (ONCL), accepted the position of honorary president. Ch. Bihoreau, a former president of AFTP and director of technical services of ONCL, was nominated president of the Congress.

The task of making arrangements for the meeting was placed in the hands of an organizing committee made up as follows:

A. de Boulard, president AFTP and engineering adviser to Omnium International des Petroles; A. Boissard, representing Exposition Internationale de Paris; H. Bouvier, managing director Soc. des Raffineries de Petrole de la Gironde; L. Chové, director technical services, Soc. An. des Petroles Jupiter; H. de Oezancourt, chief geologist, Cie Française de Petroles; P. Dumanois, Inspector-General of Aeronautics; G. Ermakoff, engineer ONCL; A. Galliot, adviser to the Director of Mines; J. Hure, director, Soc. Generale des Huiles de Petrole; K. Kaplan, director, Soc. An. des Petroles Jupiter; E. F. H. Mercier, president, Compagnie Française des Petroles; A. Pelissier, general manager, Pechelbron SAEM; S. Scheer, director, Standard Franco-Americaine de Raffinage; R. Sigwalt, president, Assoc. des Anciens Elèves de l'Ecole Nationale Superieure du Petrole; J. Thibault, director of mines, Ministry of Public Works; H. Weiss, director, Ecole Nationale Superieure du Petrole; P. Woog, director of Laboratories, Cie. Française de Raffinage; and J. Filhol, general secretary.

The meeting place of the Congress was the Maison de la Chimie.

The managing committee of the Congress decided that its deliberations should be divided over the following five sections: Geology and Drilling; Physical Chemistry and Refining; Materials and Construction; Utilization of Petroleum Products; and Economics and Statistics.

In addition to the organizing committee, which had the duty of making local arrangements for the holding of the Congress, international committees were formed in Austria, Belgium, Germany, Great Britain, Holland, Poland, Romania, Russia and the United States, these committees being charged with the procurement of papers for the meeting from their nationals.

The second Congress was attended by 1,630 registered delegates from 33 countries, while 23 governments sent accredited delegates.

One recalls that Paris was blessed with ideal weather during the whole of the Congress, and provided a delightful setting for such a purpose, adding to the pleasure of the delegates and their friends.

The Paris Congress was inaugurated by

The rose garden of Queen Juliana's residence, "The House in the Wood," where she received officers of the Third World Petroleum Congress.

Prince Bernhard, patron of the Third Congress, accompanied by Jhr. O. C. A. van Lidth de Jeude, president, entering the Ridderzaal for the formal opening of the Congress.

Thomas Dewhurst, who had been president of the London meeting. He mentioned the change of policy regarding the holding of a Congress every three years, to that of holding it at suitable times, so as to avoid clashes with arrangements made by other organizations. He also stressed the fact that the Congresses were not only of importance to the petroleum industry, but also to governments, owing to the international character of the industry.

Following the inauguration came the selection of the Congress Bureau in which Col. Pineau as honorary president was supported by Ch. Bihoreau, director of technical services of ONCL, as president and the following members: Serge Scheer, president AFTP; Lt.-Col. S. M. J. Auld, president of the Institute of Petroleum of Great Britain; J. E. C. de Percy, president of the Netherlands national committee; T. Dewhurst, past president, Institute of Petroleum of Great Britain; Dr. Gustav Egloff of the American national committee; Prof. P. Erculisse, president, Belgian national committee; Dr. W. P. Haynes, president, American Association of Petroleum Geologists; Dr. Krazec, president, Romanian national committee; Prof. Stanislas Pilat, president, Polish national committee; Dr. Strienta, president, Austrian national committee; and Prof. L. Ubbelohde, Germany.

On the evening of its first day's meeting in Paris, the Congress was honored by the presence of M. Albert Lebrun, President of France.

In addition to its divisional meetings, the Congress heard a series of lectures by distinguished authorities. The lecturers and their subjects were: Dr. Ipatieff, *Polymerization;* Dr. Gustav Egloff, *Synthesis;* Prof. L. Ubbelohde, *Viscosity;* Prof. H. Weiss, *Chemical Problems;* and Hubert Ruf, *Standardization Committee of International Standards Association.*

At its closing session the Congress took what probably was its most important action by establishment of a Permanent Council consisting of members of its national committees. Col. Louis Pineau of France was designated as president of the Council with the following members: Dr. Max Strients, Austria; Prof. Paul Erculisse, Belgium; Charles Bihoreau and Serge Scheer, France; Prof. L. Ubbelohde, Germany; Ing. J. H C. de Brey, Holland; Dr. Stanislas Pilat, Poland; Prof. L. M. Krazec, Romania; Dr. Gustav Egloff and Dr. W. P. Haynes, United States; and Lt.-Col. S. M. J. Auld and Thomas Dewhurst,

United Kingdom. As permanent secretary of the Council the secretary of the Institute of Petroleum was appointed and permanent headquarters were placed at the London offices of the Institute. In view of subsequent developments, the creation of the Permanent Council assumed invaluable importance in creating a representative body which gave the Congress a continuing existence while serving as an effective planning and directing authority.

Out of the deliberations of the technical sections of the Paris Congress came a number of resolutions urging the Permanent Council to study and compare different publications on the subject of standardization in order to avoid overlapping, to encourage studies of corrosion, evaporation losses and viscosity-temperature relationship and to take steps for the provision of authentic statistics of the industry for use at future Congresses.

The first meeting of the Permanent Council following the Paris Congress was held in October 1937 and at that time it was agreed that the next Congress should be held in Berlin in 1940. Later meetings were held in Brussels and in Dusseldorf during the early months of 1939, but the outbreak of war later in that year caused all plans to be abandoned and economic conditions following the war postponed further consideration.

At a meeting of the Council in June 1949, however, it was decided to accept the invitation of the Royal Institute of Engineers of Holland to hold the Third World Petroleum Congress at The Hague in 1951 and at a later meeting the exact dates of May 28-June 6 were fixed for the meeting.

An organizing committee then formed in Holland with G. A. Tuyl Schuitemaker, member of the council of the Royal Institute, as president and A. A. G. Schieferdecker, vice president. Other members were: J. A. Beukers, Standard Amerikaansche Petroleum; A. Beydals, Caltex; Prof. J. J. Broeze, Applied Scientific Research Section, Royal Institute of Engineers; Dr. J. Heslinga, Council of the Petroleum Section, Royal Institute of Engineers; Dr. H. H. Mooy and N. P. Pel, Royal Dutch/Shell; Dr. J. N. J. Perquin, Netherlands representative on the Permanent Council; Dr. J. C. Vlugter, president of the Chemical Technology Section, Royal Institute of Engineers; and W. F. Westeneuk, Compreno N.V. J. W. Zwartsenburg of Royal Dutch/Shell was appointed secretary.

As an indication of the growth in size and importance of the petroleum industry and its rapid development on the scientific and technical sides, the managing committee found it necessary to increase to ten the number of sections for the consideration of papers during the Congress, and these were designated as follows: Geology, Geophysics and Geochemistry; Drilling and Production; Refining Technology, Physico-Chemical Methods; Refining Technology, Processes Involving Chemical Conversions; Production of Chemicals from Petroleum; Measurement, Control Testing and Chemical Analysis; Utilization of Products; Construction of Equipment, Materials and Corrosion; Transport, Storage and Distribution; and Economics, Statistics and Documentation.

The Congress was held under the presidency of the Hon. van Lidth de Jeude, president of the Royal Institute of Engineers, with HRH Prince Bernhard of the Netherlands as the patron. Vice presidents of the Congress were: Prof. M. Boldrini, Italy; Prof. P. Erculisse, Belgium; R. Navarre, France; Frank M. Porter, United States; C. A. P. Southwell, Great Britain; and Dr. Gustav Thery-Fombona, Venezuela.

The official opening of the Congress took place in the thirteenth-century Ridderzaal in the presence of Prince Bernhard and of Prof. J. R. M. van den Brink, Netherlands Minister of Foreign Affairs, who made the opening speech welcoming the Congress and delegates to Holland.

In addition to the meetings of the various sections, four special lectures were given before the Congress as follows: Prof. J. J. Broeze, Royal Dutch/Shell Laboratory, Delft, *Future Aspects of the Applications of Fuels and Lubricants;* Prof. C. Hugel, Institut Francais du Petrole, *Recent Advances in the Chemistry of Crude Oil and its Products;* Dr. G. M. Lees, Anglo-Iranian Oil Co., *The Oilfields of the Middle East;* and Dr. E. V. Murphee, Standard Oil Development Co., *Benefits of the Petroleum Industry from Research.*

In addition to the general lectures and meetings of the various sections attended by the delegates and visitors, who numbered about 2,700, the Congress was marked by festivities of many kinds, including a cocktail party given by the organizing committee; a government reception at Old Wassenaar Castle, now used as a hotel for missions to the Netherlands; a reception at the Circle "de Witte" by the Burgomaster, Maitre F. M. A. Schokking; a garden party by the Queen for officers of the Congress; receptions by the American Ambassador and various private organizations; and the official banquet held at the Kurhaus at which the toast "Our Hosts of the Netherlands" was proposed by P. R. de Rijckers, deputizing for Prof. Erculisse of Belgium, with responses made by Prof. Boldrini, Italy; Gustav Thery-Fombona, Venezuela; Rene Navarre, France; and Frank M. Porter, president of the American Petroleum Institute. C. A. P. Southwell of Great Britain proposed the health of the ladies, several hundred of whom were present.

An enjoyable feature of the Congress was provided by the tours arranged to different parts of Holland which proved to be very popular with the visitors.

The Plenary Session of the Congress was held at the Kurhaus on June 6 at which a number of resolutions were proposed and unanimously adopted.

Many of these took the form of requests to the Permanent Council to make recommendations to various societies and associations to encourage special studies. Sedimentary petrologists of Section 1 asked for further study of the regional distribution and variation in the properties of sediments. Another group in the same section wanted a study of migration and the factors controlling it.

Section 2 proposed an extension of standardization in specifications for certain equipment and in the nomenclature applied to it. Another recommendation was for renewed attention to a proposal advanced in 1933 on viscosity determination and expression. Section 8 urged a broader exchange of information on construction materials and Section 10 proposed the adoption of an international standardized vocabulary of petroleum terms and definitions.

These are only a few of dozens of resolutions submitted by the different sections covering the entire range of the petroleum industry and indicating the strong interest in international co-operation which stems from the meetings of the Congress.

The final action of the Third Congress was the election of members of the Permanent Council to serve until the ending of the fourth meeting. Dr. E. V. Murphree was the unanimous choice for president of that body, with G. A. Tuyl Schuitemaker of Holland, Serge Scheer of France, C. A. P. Southwell of Great Britain and Dr. C. Perez de la Cova of Venezuela as vice presidents.

D. W. Harris, president of Universal Oil Products Co.

Ten strenuous years of reorganization of Universal Oil Products Company have built an oil education and research fund of a million and a quarter dollars from which grants now are being made by an American Chemical Society committee.

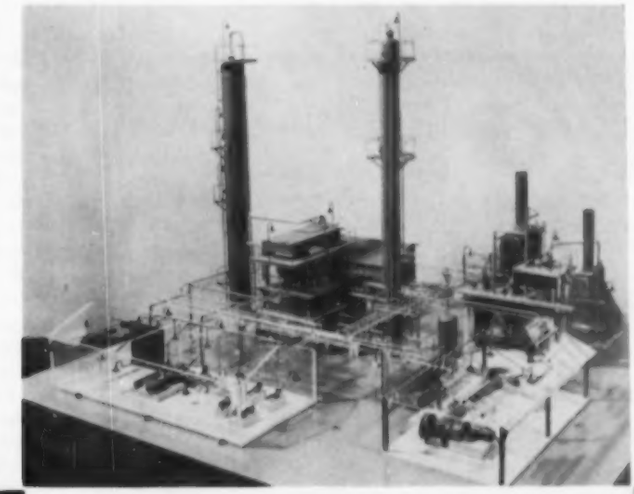
DAVE HARRIS EARNS A SERVICE PIN

View of the entrance to the UOP office building, Des Plaines, Ill. by amateur photographer Dave Harris.

DAVID WILLIAM HARRIS, who has just won his ten-year service pin as president of Universal Oil Products Company, is a member of that large group of oil men who trace their start in the industry to the interest of the late Henry L. Doherty in the training of young engineers. Had it not been for Mr. Harris' determination, he would have missed that opportunity.

"Dave," as he is known to most oil men, sought an appointment as engineer trainee when a Cities Service scout visited the campus of Georgia Institute of Technology during his senior year. The appointment went to another student, but Dave was unwilling to accept defeat. He wrote to New York and the result was an appointment to the Denver Gas and Electric Co. engineering training school. His starting salary was $50 per month.

After two years at Denver, Mr. Harris was transferred to New York general headquarters of Cities Service as an engineering statistician. From that position he moved into budget work and was made an assistant treasurer. Becoming interested in executive problems, Mr. Harris began to study the techniques of management and rapidly moved ahead. He was sent to Bartlesville, Oklahoma, as treasurer of a Cities Service company. Successively he became vice president of Indian Territory Illuminating Oil Company, vice president and general manager



Left, model of the first commercial Platforming unit at the Muskegon refinery of Old Dutch Refining Co.

Below, UOP's Shreveport, La. catalyst plant.

Air view of UOP research and development laboratories at Riverside, Ill.

of Arkansas Natural Gas Corporation, president of Orange State Oil Company, vice president and director of Cities Service Defense Corporation, and president of Arkansas Natural Gas Corporation and all of its subsidiaries.

While still in his thirties, Dave Harris had become president of a Cities Service subsidiary, and he was president of Arkansas Natural Gas Corporation ten years ago when he was invited to Chicago as chief executive officer of UOP.

It is most appropriate that Mr. Harris should be head of an organization which is now devoted to the advancement of engineering and scientific education. His father, one-time governor of Georgia, was instrumental in founding Georgia Tech. As a young member of the Georgia State Legislature, Nathaniel Harris succeeded in obtaining the first appropriation to establish a school that would enable southern boys to study engineering without going to a northern university. Dave has followed in his father's footsteps by interesting himself in the advancement of education. As recognition of his personal and business interest in furthering educational advantages, Georgia Tech dedicated a campus gate in his name in 1953, and in 1954 he was selected to receive the Georgia Tech Alumni Distinguished Service Award for that year.

Despite his heavy business schedule, Dave still finds time to relax and enjoy life. Early in his life he learned to play the piano by ear and contributed to the enjoyment of his friends. He is an enthusiastic amateur photographer and his work has the technical excellence of the professional. One of his snapshots occupies the page at the beginning of this article. Another, enlarged to mammoth proportions, serves as a striking mural in the UOP reception lobby at the company's new office building at Des Plaines, Illinois. Hunting is another of his avocations, and his friends say that he is an excellent shot, seldom missing when hunting quail, duck or pheasant.

A group of friends and associates recently gave a dinner in his honor in Chicago. The dinner was in recognition of the development and growth of Universal Oil Products Company under his leadership during the past ten years since the company was given by its former owners, under a trusteeship, for the promotion of education and research in the petroleum field.

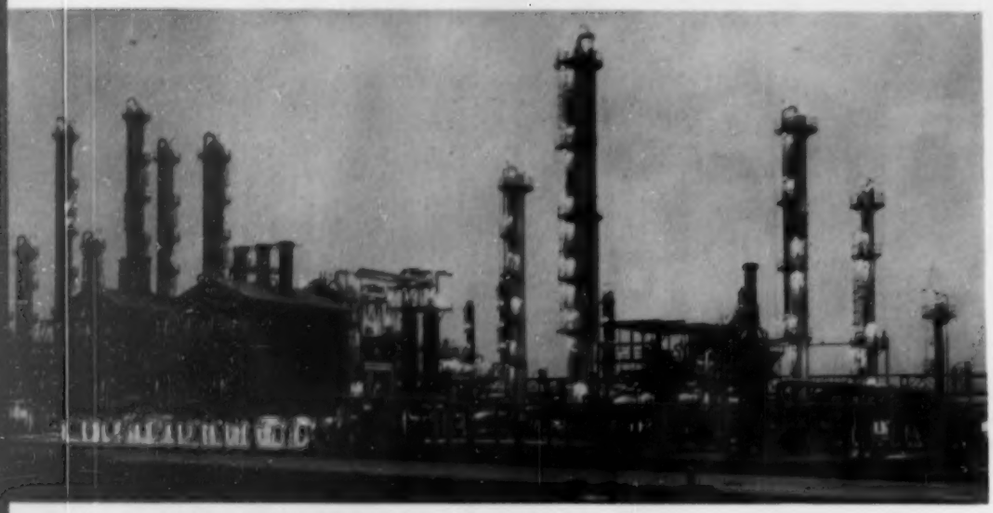
As one result of the first post-war decade of UOP operation under Mr. Harris' management, 37 fundamental research projects were in progress last year at nearly as many American universities. From a fund of more than a million and a quarter dollars, derived from UOP earnings, the American Chemical Society made grants in aid totaling $164,367 during 1954.

Judging from the remarkable expansion of UOP in the past ten years and its present scope of activity, it may be assumed that the Petroleum Research Fund Advisory Board of the ACS will be able to extend aid to a widening group of research projects and to advanced scientific education in the years to come.

There were some, in 1954, who advised Dave Harris against resigning as president of a company he had built into a prosperous operation to accept the responsibility to the industry and public of making a go of UOP. There were knotty problems to be solved in the new job.

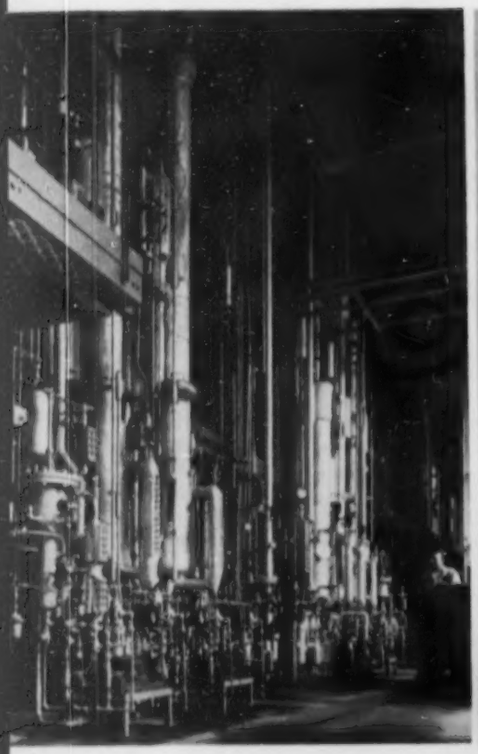
During World War II, UOP had devoted the energies of its staffs almost exclusively to the production of aviation fuels. Research seeking to develop new peacetime commercial processes or to improve older processes had to be put in moth balls. Wartime processes for isomerization of normal hydrocarbons and alkylation of unsaturates to produce fighting grades of avgas were important during the war, but were of little commercial value following VJ day.

UOP was becoming somewhat middle-aged. In its thirty boisterous years of cracking development and litigation, it had used up most of the life of its most important patents in the field of thermal cracking and reforming. The company had built up a good patent position in the field of fluid catalytic cracking during the

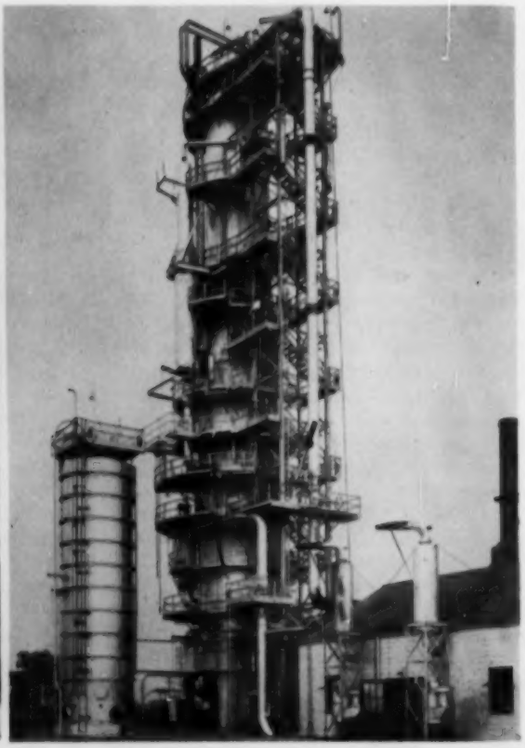


Shell's 16,000 b/d Platformer at Houston, Texas.

Pilot plant in the Riverside research laboratories.



First unit of UOP's small-size fluid cat cracker went on stream in mid-1947 at the Detroit refinery of Aurora Gasoline Co.



war, but its traditional customers couldn't afford the usual cat crackers. They had to be big and were expensive. Small units like the old thermal plants on which UOP had grown were not considered feasible.

In the early years of the development of the cracking art, UOP had become involved in a tremendous amount of litigation. Much of this was still pending at the close of World War II. The future burden of defending legal actions was a formidable contingent liability. Federal taxes were in controversy for several years. Employees of UOP were not sanguine as they examined their future with the company. Many were seeking new jobs. Some had already resigned.

That was the picture that Mr. Harris was invited to face. Besides, at the time the decision was made, it was cold in Chicago—zero—and Dave was a southerner by birth and long residence. But he bundled up and took the job anyway.

First task of the new administration was to re-establish confidence in UOP on the part of both employees and customers. Antagonists in the field of litigation had to be assured that UOP "wasn't mad at anybody" but, on the contrary, was willing and anxious to settle past differences. Bitter enemies had to be reconverted into friends and customers.

Dave Harris put on his selling clothes and went out after business. He walked right into the offices of antagonistic companies, announced a new policy and began to get orders. With these in his pockets, the next big job was to build up the engineering and scientific staffs of UOP and to start a new program of research into peacetime processes and products. In May 1945, 181 research workers remained on the UOP staff; today there are 358 men devoted to research in a greatly expanded operation.

Since thermal processes were obsolescent, the energies of UOP researchers and engineers were channeled into catalysis. This was not a new field to the company: Professor Vladimir Ipatieff and Hans Tropsch, top-rated European scientists, had previously helped UOP develop catalytic polymerization with a phosphoric acid catalyst, a process which is now installed in a majority of the world's cracking plants. From UOP laboratories had also come HF-alkylation for aviation gasoline.

During the war the octane race was quiescent, but once the conflict was over, quality competition among refiners became keener than ever. The small refiner began to fear for his future when he reached the octane limit obtainable through thermal cracking, reforming and blending with tetraethyl lead. At the close of the war, a cat cracker of 5,000 barrel daily capacity cost about $350 per barrel to build. A 20,000 barrel unit cost $200 per barrel. High investment militated against the small refiner.

UOP engineers were given the task of developing a new fluid cat cracker which could be built with a lower investment and depreciation factor. They came up with the answer: reactor and regenerator were integrated into a single structure, the reactor above the regenerator. Flow lines were shortened and simplified. Much less steel was required and both capital investment and operating costs were reduced.

The new design for a small fluid cat cracker was produced quickly. The first unit was sold in 1946 and was on-stream by mid-1947 at the Detroit refinery of Aurora Gasoline Company. First of the new units had a capacity of 3,300 barrels of fresh feed per day. Since that time, UOP had designed and licensed 51 fluid cat crackers. Following is a breakdown of the various units by size:

1,000 to 4,999 b/sd	— 28
5,000 to 9,999 b/sd	— 12
10,000 to 14,999 b/sd	— 7
15,000 to 19,999 b/sd	— 3
Over 20,0000 b/sd	— 1
Total	51

Continuing his efforts to stabilize company operations and income quickly, Mr. Harris recognized that UOP had amassed a tremendous amount of know-how in the 31 years since the first UOP research laboratory was established at Independence, Kansas. He reasoned that this vast store of knowledge could be advantageously utilized by refiners, so it was offered to them on a service basis. A service group was organized and placed in the field to provide adequate service for those refiners who wanted the advantages of such an arrangement. Behind these field technical service men were the UOP laboratories at Riverside with facilities for evaluation of crude oils and the solution of processing and treating problems.

The present UOP service department consists of 123 employees, the majority of whom are continuously assigned to field work away from the home offices. There are eight service coordinators at the Des Plaines office. Treating and inspection problems are handled independently by separate divisions. There are 13 district men in field service work who are permanently located at different points throughout the United States, and 66 field service men, 34 of whom are presently assigned to jobs outside the continental limits of the United States. The inspection department has 28 employees, with 26 continuously employed in the field to inspect UOP licensed units.

New products as well as new processes have been developed by Universal over the years. Shortly after Mr. Harris joined the company, one manufacturer who had been producing a gasoline antioxidant for UOP decided to enter that field on its own and accordingly cut off its supply to Universal. This experience convinced Mr. Harris that UOP should diversify its activities to include manufacturing. Today the company operates several manufacturing plants in the United States, and has a 50 percent interest in a plant in England.

At McCook, Illinois, the manufacturing subsidiary, Universal Polychem Company, produces Hydrobon and Platforming catalysts and a variety of chemicals employed in the petroleum, rubber and food industries. Among these are antioxidants for gasoline, Driacin (an additive for fuel oil to prevent oxidation and retard rust formation in storage tanks) and a new product developed and marketed as a rubber antioxidant. Unicor, another product, is an organic surface-active corrosion inhibitor originally developed to retard internal corrosion by chlorides, sulfides and salts in oil refineries. More recently it has been employed in the production, transportation and marketing fields and as a gasoline additive. Another gasoline additive is UOP copper deactivator used to offset the catalytic effect of copper in gum formation. Sustane, another additive, is used in the food field to prevent oils, fats and waxes from becoming rancid during storage.

In addition to facilities at McCook, Universal built a large plant at Shreveport, Louisiana, to produce Platforming catalyst. In England, UOP joined with Johnson, Matthey and Company Limited, British platinum refiner, to form Universal-Matthey Products Ltd., and a plant was erected to manufacture catalyst for refiners in the Sterling area. The British factory was completed and placed in operation in November 1954.

To further broaden the company's base, Mr. Harris organized Procon, Incorporated, as an engineering and construction contractor for the petroleum and the petrochemical industries. Procon was organized in 1950 and spent much of its time at the start building Platforming units. More recently it has expanded its activities in construction to include the chemical industries and has entered the refinery maintenance field. Turnaround service is being offered to refiners who desire to retain only a limited maintenance personnel. Procon has completed seven turnaround jobs in the first quarter of this year. In addition to the usual construction crews, an administrative, sales and engineering staff of 228 has been built up.

With Procon, Mr. Harris has rounded out the old UOP organization from its original functions as a research and development company offering process licenses to include technical service to non-licensees, engineering and construction contract services and the manufacture of chemicals and catalysts. His theory was that a research firm does not bring out a new process every year or so and it must therefore be subject to wide fluctuations in load factor. With diversification he sought to eliminate or minimize such surges.

Dave Harris is a lean man, amply endowed with nervous energy and drive. Because of his nature he was unwilling to accept the dictum that researchers must lead a leisurely life of quiet contemplation in the laboratory. It has been said that seven years is the average time lapse between the conception of a new process and its successful commercial application. Mr. Harris told his research people that success had to be based on intensive development of new ideas at high speed. Competition is severe in every branch of the oil industry, not excluding research. So ideas must be developed quickly or someone else will get there first.

There are many examples of speedy development by UOP in the past ten years. Outstanding is the history of Platforming. On the basis of bench and pilot plant research, UOP announced the new process in March 1949 at the annual meeting of the Western Petroleum Refiners Association. One Michigan refiner attending the meeting had been worrying about his inability to meet major company octane competition. From the meeting he went direct to Chicago and worked out a licensing and construction agreement with UOP. Seven months later the first commercial Platforming unit was operating at the refinery of Old Dutch Refining Company at Muskegon. In that brief period engineering and design work had been completed, equipment ordered and erected.

Some research and development groups in the industry had been working on catalytic reforming before Platforming was announced. Others began their work after the WPRA paper was presented, but the Harris philosophy of top speed paid off in orders before competitive processes became commercially available. As the first in the field with a successful commercial unit in operation, Universal was able to license and build a large number of plants before competition got tough. As shown in the accompanying list, UOP has licensed 81 refining companies to operate Platforming units and there are now 120 plants in service, building or licensed in 14 countries. In the United States there are 88 plants; in Canada seven; England, Germany and Japan four each; in Australia three; in Italy and Lebanon, two each; and in Aden, India, Spain, France, Cuba and Belgium one Platformer has been built or licensed.

Intensive research and development work preceded the public announcement of Platforming. Previously, UOP was working on chrome-alumina catalysts for reforming, but was not happy with results. From the first day when Dr. Vladimir Haensel proposed platinum as a reforming catalyst, the pace was fast. It was first necessary to determine whether

the catalyst would work. Once this was proved the problems really began. Platinum metal was selling at approximately $100 per ounce. The first catalyst prepared for the process had a three percent platinum content. The finished catalyst cost $50 per pound, and its activity was low, which meant that large amounts would be required.

There wasn't enough platinum in the world to develop a significant reforming process on a commercial scale employing a catalyst containing three percent platinum content. Besides, $50 per pound was entirely too much money to make the process economically within reason. So, unremitting work went on, and from time to time Dr. Haensel reported that he had found ways of reducing the platinum content of his support or of increasing its activity. Each time he was sent back to the laboratory to seek further reduction. When the cost of the platinum content of a pound of high activity catalyst had been reduced to $5, the drive for commercial application began with the results already noted.

The development of a suitable catalyst was only one of the complex problems that faced UOP staffs. Many experiments and much design work was required to determine optimum operating conditions and to decide between the various proposed process flows.

Engineering presented any number of difficulties, and material and construction cost factors were all-important in determining the economic feasibility of a commercial unit. It was necessary to solve these and numerous other problems before Platforming became a reality.

Much of the octane improvement obtained in Platforming results from the dehydrogenation of naphthenes to produce aromatics. When the Korean conflict broke out an immediate study was undertaken to find a new low-cost method of separating individual aromatics from Platformate. The process used for toluene recovery in World War II was considered too complicated. Dow Chemical Company was understood to have proposed a mixture of glycol and water as a selective solvent for extracting aromatics from a mixed hydrocarbon stream. By agreement with Dow the UOP organization engineered the proposed process, developing equipment features which permitted the recovery of nitration grade toluene and benzene plus a high purity concentrate of ethylbenzene and xylenes.

By 1951, the Udex process had been proven on a pilot plant scale, the first installation had been sold to Eastern States Petroleum Company at Houston, and in the early spring of 1952, the unit was on stream and producing mixed aromatics. A few months later, Cosden Petroleum Corp., at Big Spring, Texas, began manufacturing and selling high purity individual aromatics extracted by Udex as intermediates for the Chemical industries. Today there are seven Udex plants in operation or under construction in the United States, and they are supplying the demands of the chemical industries which could not be supplied by coal tar plants. Udex plants are now being operated by Great Southern Chemical Corp., Corpus Christi, Texas; Roosevelt Oil and Refining Corp., Mt. Pleasant, Michigan; Sinclair Refining Co. and Sun Oil Co., both at Marcus Hook, Pa.; and the Standard Oil Co. (Ind.) is building a plant at its Whiting, Indiana refinery. One foreign plant is in operation at the CEPSA refinery in the Canary Islands.

Another cooperatively developed process is Unifining, on which parallel work had been done both by UOP and Union Oil Co. of California. The process also is an offshoot of Platforming in that it was made commercially attractive by the availability of by-product hydrogen from the dehydrogenation step in catalytic reforming.

The first commercial Unifining plant was placed on stream by the United Refining Co. at Warren, Pa., in February of last year. United uses the process for treating of kerosine and other distillates to produce stable, essentially sulfur-free products. Since that time, 18 refineries have become Unifining process licensees. Of these, 15 are in the United States, and three in foreign countries. The process is being largely employed in the pretreatment of raw materials for Platforming to widen the choice of stocks suitable for reforming. A cobalt-molybdenum type catalyst is used.

Latest UOP development in the catalytic reforming field is Rexforming, which was announced two months ago at the annual meeting of the Western Petroleum Refiners Association. This new development extends the Platforming step to convert unreacted paraffins by recycling. Pilot plants have produced gasolines with octane numbers above 100 clear.

In order to recycle the unreacted paraffins, the Platformate is passed through an extraction tower to remove aromatics. The low octane components are again subjected to catalytic action by recycling. Mild conditions are maintained to obtain optimum yields and quality. The finished Rexformate is water white, rich in aromatics and contains substantial concentrations of high octane paraffins.

Mr. Harris and his staffs feel that Rexforming has come at an opportune time in view of the accelerated rate at which automotive engine compression ratios are being advanced. This year there are a number of 8.5 : 1 compression ratio cars. A 10 : 1 engine is expected in 1956 and a ratio of 12 : 1 is not too far distant. Two years ago less than nine percent of the new cars required premium fuel. This year premium gasoline is recommended for half of the new models.

Premium fuels are expected to repre-

UOP PLATFORMING LICENSEES

Anderson-Prichard Oil Co.
Anglo-Canadian Oils, Ltd.
Anglo-Iranian Oil Co., Ltd. (Now The British Pet. Co., Ltd.)
Atlas Processing Co.
Aurora Gasoline Co.
Bell Oil & Gas Co.
Big West Oil Co. of Montana
Bitumen & Oil Refineries, Ltd.
B. P. Benzin und Pet. G.M.B.H.
Burmah-Shell Ref. Ltd.
California Oil Co.
Canadian Oil Refineries, Ltd.
C.E.P.S.A.
Champlin Refining Co.
Cal-Tex Refining Co.
Continental Oil Co.
Cosden Petroleum Corp.
Donaho Refining Co.
Eastern States Pet. Co., Inc.
El Dorado Refining Co.
Elk Refining Co.
Famariss Oil & Ref. Co.
Frontier Refining Co.
Gelsenberg Benzin A.G.
Gewerkschaft Deutsche Erdol-Raffinerie (Deurag)
Great Southern Chemical Corp.
Gulf Oil Corp.
Illinois Farm Supply Co.
Industria Raffinazione Olii Minerali (IROM)
Johnson Oil & Ref. Co.
Kendall Refining Co.
Koa Oil Co., Ltd.
Lake Superior Ref. Co.
McColl-Frontenac Oil Co., Ltd.
McMurrey Refining Co.
McNutt Oil & Ref. Co. Inc.
Mediterranean Ref. Co.
Mid-West Refineries, Inc.
Mitsubishi Oil Co.
Mohawk Petroleum Co.
Naph-Sol Refining Co.
National Cooperative Refinery Association
Nippon Petroleum Ref. Co.
Old Dutch Refining Co. (Now Aurora Gasoline Co.)
Onyx Refining Co.
Pennzoil Co.
Petco Corp. (Now Clark Oil & Ref. Corp.)
Petroleum Specialties, Inc.
Phillips Petroleum Co.
Pontiac Refining Corp.
Premier Oil Refining Co.
Purfina Italiana S.p.a.
Quaker State Oil Ref. Corp.
Republic Oil Refining Co.
R. J. Oil & Refining Co.
Rock Island Ref. Corp.
Roosevelt Oil & Ref. Corp.
Rothschild Oil Co.
S.G.H.P.
"Shell" Cuba-Cia Petrolera la Estrella de Cuba, S.A.
"Shell" Deutsche A.G.
"Shell" Refining and Marketing Co., Ltd.
Shell Oil Company
Shell Oil Company of Canada, Ltd.
Showa Oil Company
Skelly Oil Company
Southwest Gas Producing Co.
Standard Oil Co. of British Columbia
Standard Oil Co. of Calif.
Standard Oil Co. (Ohio)
Standard Oil Co. of Texas
Sun Oil Company
Sunray Oil Corp.
Tankage & Transport, S.A.
Taylor Oil & Gas Co.
Texas Gas Corp.
The Texas Company
Tide Water Associated Oil Co.
Trinidad Leaseholds (Canada) Ltd.
Union Oil Company of Calif.
Wilcox Oil Company

sent 35 percent of total gasoline sales this year and as compression ratios go higher in more cars, the demand for premium gasoline will rise. It is apparent that octanes will go to 100 or more within a reasonable period, which means that Rexforming is just what the refiner will need to make fuels to power the improved auto engines economically. The commercial application of the new process gives the refining industry another method of improving its products and keeping in step with market demands.

Physical facilities of UOP have been expanded and modernized at a rapid pace under the Harris regime. Early analysis by Mr. Harris indicated that the investment per man was low. First step was to increase the facilities at the Riverside laboratories, and to acquire much new, up-to-date equipment.

Next step was to purchase a large site at Des Plaines, Illinois, a suburb of Chicago, and to construct a new administrative and engineering building to accommodate the growing staffs of UOP and Procon. The new structure, occupying a 75 by 360 foot space on the 54-acre tract, was completed in the fall of 1952. Since that time construction has started on a new laboratory building which will house most of the research and development staffs. When this building is ready to be occupied later this year, part of the present Riverside activities will be transferred to Des Plaines. Space has been provided for all of the chemical, product and process research labs, the physics labs, high pressure and autoclave labs, bench scale and semi-works, etc. While space for the automotive labs is not provided in the new building, improved and expanded facilities for this important activity are contemplated and already in the planning stage.

Mr. Harris feels that the centralization of important research, development and engineering activities will contribute to a more satisfactory operation, and will permit the company to conserve time and to serve its many licensees more efficiently. The new facilities are the direct result of his study of operational problems and the cooperative planning of the administrative and general staffs.

As mentioned earlier, the history of UOP goes back to the earliest days of thermal cracking at the start of World War I when Jesse A. Dubbs enlisted the financial support of J. Ogden Armour. The story is told that after the death of Mr. Armour, his executors found a UOP stock certificate and for a time considered it to be of little or no value. Later, when UOP was sold for more than $25 million, the securities being acquired by a group of major oil companies, Mrs. Armour's share was said to be about $12 million.

The next 14 years were perilous ones for the company. Many of the major oil companies had obtained immunities, both under UOP's existing patents and on all subsequent patents based on inventions over an extended period of years. These arrangements permitted Universal to realize licensing income from only a small part of the refining industry. UOP managed to survive despite this handicap and the rigors of depression, concentrating its attention on the special problems of the small, independent refiner.

The period immediately preceding and during World War II provided the company with a temporary surge in business, but interfered with its normal research and development program. Additionally, a number of outstanding legal actions threatened to deplete the company's meager reserves and to render it impotent as a factor in the field of process development for the refining industry.

This was the situation when, in 1944, Universal experienced another change in ownership. At that time the major oil companies, which held all UOP securities, decided to divest themselves and did so by donating the securities to the Guaranty Trust Co. of New York as trustee for the newly created Petroleum Research Fund. Subsequently, Universal's board of directors and the trustee persuaded Mr. Harris to come in as president and a member of the board.

Income derived from Universal's present operations is allocated through a committee of The American Chemical Society for advanced scientific education and fundamental research in any branch of the petroleum field. Under the terms of the trust agreement, UOP is obligated to continue its research and development activities.

A committee of 13 members of the ACS comprises an advisory board that examines requests and approves grants from the funds derived from Universal through The Petroleum Research Fund. This committee is headed by Dr. Cary R. Wagner. Other members are: Dr. R. W. Richardson, Esso Research and Engineering Company; Dr. Fred E. Frey, Phillips Petroleum Company; Dr. W. E. Kuhn, The Texas Company; Dr. Kenneth S. Pitzer, University of California; Dr. Paul H. Emmett, Mellon Institute of Industrial Research; Dr. Harold Gershinowitz, Shell Development Co.; Dr. A. L. Lyman, California Research Corp.; Mr. High W. Field, The Atlantic Refining Company; Dr. E. C. Hughes, The Standard Oil Co. (Ohio); Mr. L. Laskaris, The Atlantic Refining Company; and Mr. Nelson J. Leonard, University of Illinois. The late Dr. Gustav Egloff of UOP was also a member up to the time of his death.

The advisory board, at its first meeting a year ago, set up certain "ground rules" for making grants. Grants are made for no more than one year at a time. To encourage education, predoctoral grants will be exceptional and no grants will be made to purchase equipment.

In the first six months following the announcement that grants would be considered, the advisory committee received 123 proposals. Of these, 80 were rejected and 37 recommended for approval.

View of a late-model Platformer.

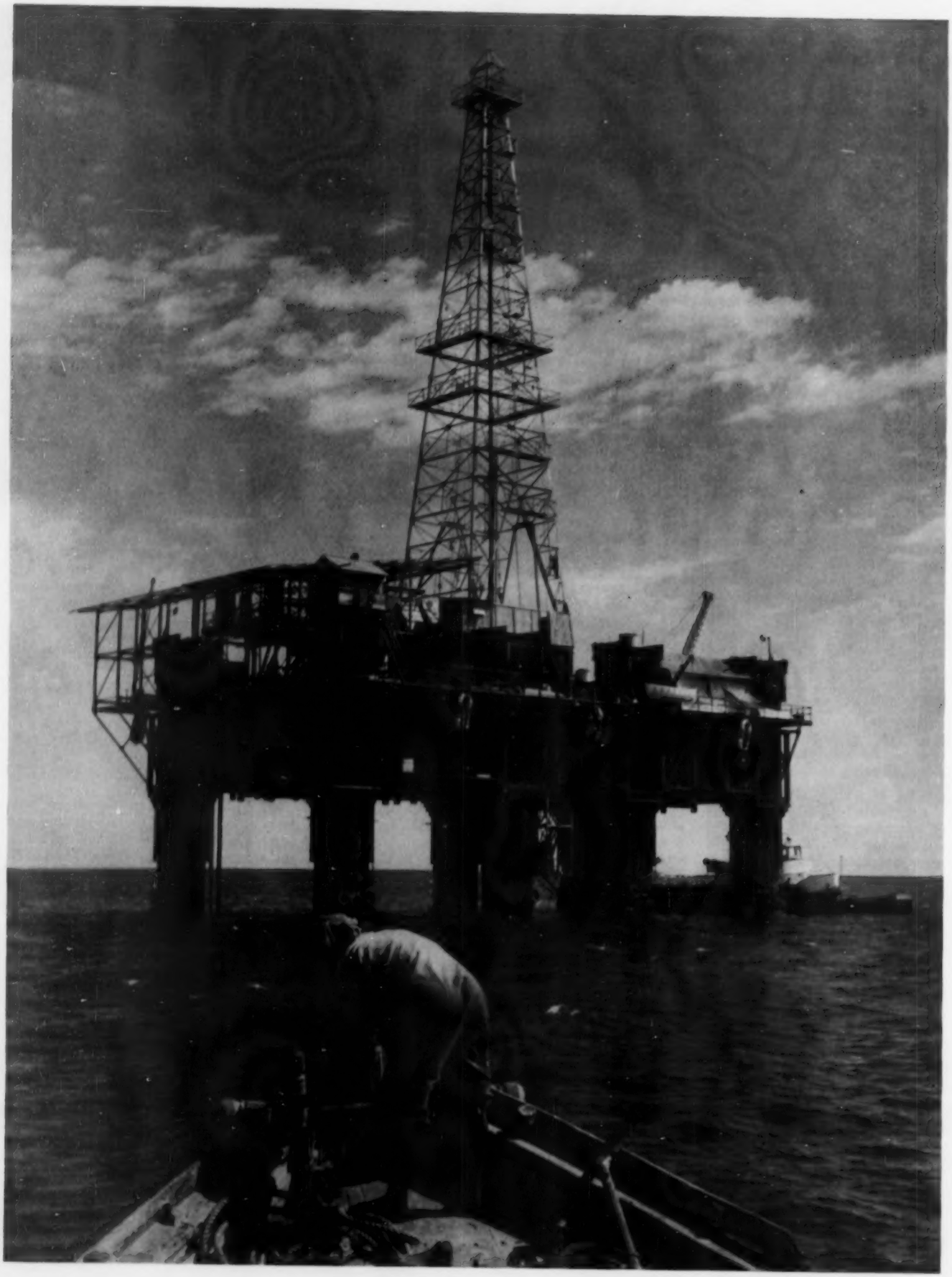
At the close of 1954, funds turned over to The American Chemical Society totalled $2,261,377.39, of which $2,201,108.30 was invested in government bonds and $60,269.09 was in cash. In the year 1954, grants totalled $164,367.

Operations of Universal itself are under the control of a board of directors selected by the Trustee. Present members of the board are: J. M. Barker, Gen. Levin H. Campbell, David W. Harris, Carl S. Miner, Guy E. Reed and Kenneth H. Rockey.

In its first ten years of operation under the Trusteeship, UOP has built up its staff to 847 directly in research, engineering, service and administrative functions. Approximately 500 persons are employed by subsidiary companies.

At the same time, UOP has diversified its operations and brought to commercial application a number of new processes. It has acquired a physical plant which is in keeping with its expanded and diversified activities.

The friends and associates of David W. Harris, who dined with him recently, attribute a major share of this development to his personality as a leader and to his sound business judgement, which has contributed to the stability and growth of an organization unique in American industry.



Drilling operations with a rig capable of reaching a depth of some 7,000 feet have begun in the Persian Gulf 35 miles north of Doha, capital of the independent Sheikhdom of Qatar. Shell photo.

SEARCH for OIL UNDERSEAS

enlists worldwide attention

By James W. Calvert

ONE OF THE MOST significant recent developments in the search for petroleum has been the attention directed to marine exploration and drilling. Production of petroleum from underwater locations is of course nothing new. One celebrated field of this kind is located in Lake Maracaibo, Venezuela. Others are off the Pacific coast of the United States, in the Gulf of Mexico, in the Caspian Sea opposite Baku and in various other locations. Until recently, however, such production has come chiefly from enclosed bodies of water such as lakes or bays or from positions near enough to shore to be reached by piers extending from land, or in places where waters were shallow enough to permit the use of sunken barges or easily constructed platforms to support the drilling machinery. Obstacles to exploration at greater depths were the heavy costs of constructing bases and superstructures capable of resisting the heavy storms that not infrequently sweep over open waters, the problem of transporting oil that might be found far offshore and other expensive features that made marine drilling several times as expensive as similar work ashore.

However, the configuration of offshore areas along the Gulf of Mexico, where gentle gradients extend in some cases for miles beyond the tidal line, served as a constant challenge to explorers to venture farther and farther out, while the experience gained in testing the inland and coastal waters led to the development of methods and equipment peculiarly suited to such conditions. Thus, naturally enough, the portion of the Gulf directly adjacent to the southern states became the testing laboratory of marine exploration and the workshop for devising improved mechanisms for conducting it.

The first discovery in the open waters of the Gulf of Mexico was in the Creole field in 1938. It had all the evidences of an important find, but World War II intervened and operations had to be discontinued except for the maintenance of a few small wells off the Louisiana coast near Cameron.

The geophysical crews started coming back, one by one, in the closing months of the war and in 1945 the State of Louisiana held a lease sale which opened a larger Gulf area to exploration.

New discoveries in 1947 brought more millions into tidelands exploration. This continued with increasing tempo until June of 1950, when the Supreme Court handed down a decision invalidating a large part of state claims to ownership of submerged oil lands, a decision that was corrected by Congress in 1953.

In the meantime the designers and builders of geophysical and drilling equipment had been studying the requirements of exploration in open waters and at depths considerably greater than had been attempted previously. New models of drilling platforms and servicing equipment have continued to appear and to be submitted to practical tests.

Probably the most revolutionary development has been the creation and the successful operation of the mobile drilling unit, a giant vessel which, when sunk to the floor of the ocean, becomes a self-contained drilling platform and which can be raised and moved to a new location in a matter of hours. When the first of these units was commissioned, many operators were disposed to question the sanity of the builders. Nevertheless, the mobile giants have withstood a year's operations successfully. The only case of serious damage was caused by a well blowout which might have happened in any drilling operation. In mid-April nine mobile units were at work in the Gulf and four others were under construction for completion during the summer.

"Mr. Gus," the first mobile drilling platform designed to operate in water of 100-foot depth, built last fall at the Bethlehem shipyard in Beaumont, Texas, is now drilling for Shell Oil Co.

Offshore Co., operator of the DeLong-McDermott drilling platform which literally climbs into place like a small boy "shinnying" up a tree, has added another and larger unit to its fleet, and both are leased to Humble Oil and Refining Co. as is the new American Tidelands drilling barge, the "101." A third DeLong unit is under construction at the Alexander shipyard in New Orleans, with completion scheduled for mid-summer, while the revolutionary tripod rig of Zapata Offshore Co. is still under construction by Le Tourneau and is scheduled to be completed in June.

An appreciation of the size and capacity of these mobile units may be gained from some feature of American Tidelands "101," recently completed at New Orleans.

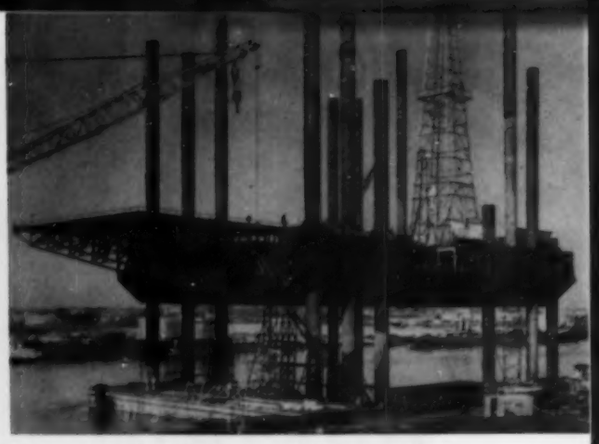
It consists of a submersible barge, measuring 200 by 74 by 12 feet. Welded to this are cylindrical steel columns, six feet in diameter, which tower vertically 52 feet above the hull to support the superstructure, a two-storied affair, comprising the drilling and storage deck, air-conditioned living quarters for a 40-man crew and a helicopter deck. The overall height from the bottom of the hull to the top of the helicopter deck is 93 feet.

On the lower level of the superstructure is the machinery deck, which houses the 5-engine compound, 2,000 hp rig, two 850 hp pumps and a 150 hp mud mixing pump. Aft of the machinery deck and amidship of the superstructure is the storage deck, where all drill pipe, casing, cementing unit, liquid mud tanks and bulk mud hoppers are located.

The mud tanks have a capacity of 1,200 barrels of liquid drilling mud and 4,800 sacks of dry mud materials. There is also additional space for a storage of another 2,000 sacks of mud and 1,500 sacks of bulk cement. Drilling water is stored

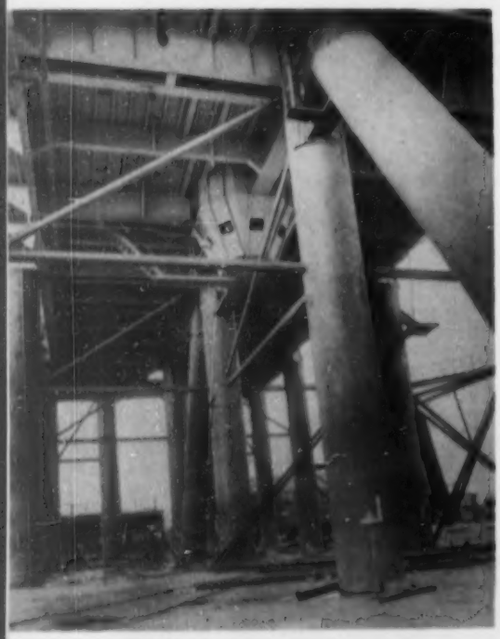
Aerial view of $1,500,000 self-contained platform drilling in 97 feet of water in the Gulf of Mexico, built by J. Ray McDermott & Co. Note helicopter landing on deck at left and stores for drilling piled in foreground.

The CATC drilling tender "J. C. Craig" as seen from the floor of the neighboring drilling rig.



This mobile drilling platform will operate in waters up to 100 feet deep. It was built for the Offshore Company by U. S. Steel's Consolidated Western Steel Division, Orange, Texas.

Bins for storing bulk mud and cement aboard the new American Tidelands drilling barge "101."



Underwater section of American Tidelands drilling barge "101" showing columns which support the drilling platform above the submersible barge.

in tanks in the forward end of the hull. These tanks have a capacity of 2,500 barrels. Two of the hollow vertical columns will be used to store 500 barrels of potable water and four others are storage tanks for 1,000 barrels of fuel oil.

The lower hull of the barge consists of a sealed steel compartment that gives the rig buoyancy and permits it to be towed to the drilling position. Once on location, sea water is allowed to flow into the barge hull, causing it to sink to the ocean floor. Big stabilizing pontoons, attached to the sides of the barge, are lowered and locked into position against the ocean floor, giving the barge complete mobility during the drilling operation. Drilling is carried on through a 42 by 26 foot slot in the after end of the submerged barge. Directly above the drilling slot and affixed to the steel deck of the superstructure is the hinged base of the jackknife derrick, which towers 142 feet above the top of the superstructure.

Despite its height and weight, the operation of the barge is relatively simple. Tugs tow the floating giant to its drilling location. When the float-barge is flooded and sinks to the ocean floor, the superstructure stands 30 or more feet above the surface of the water.

There are two types of permanent platforms in general use: one is the small platform containing only derrick and drilling machinery and capable of drilling four to six wells. Floating tenders supply power for mud pumps, living quarters for the crew, storage facilities for pipe, mud, cement, water and fuel.

The second is the giant self-contained platform which provides space for storage and living quarters as well as the drilling operations. The largest of this type built to date is the $1,500,000 platform recently completed for the CATC Group approximately 18 miles from Grande Isle, La. in 97 feet of water. Fabricated at the yard of Avondale Marine Ways, New Orleans, in eight sections, the platform is 200 by 109 feet and weighs more than 1,600 tons. As many as nine wells can be drilled from the platform, which is supported by 24 steel piles and towers 50 feet above the level of the water, high enough for protection from rough seas.

The CATC Group also recently commissioned its newest seagoing drilling tender, the third of a four-ship program undertaken at the yard of the Levingston Shipbuilding Co. in Orange, Texas. The newest tender, the "Ernie Miller," was named after the manager of Atlantic Refining Company's domestic producing department.

Like its two sistership, the "Ernie Miller" is a floating non-self-propelled vessel 260 feet long, 54 feet wide and 16 feet deep at the sides. The engine drive group consists of three Superior supercharged diesel engines, which power the three Gardner-Denver mud pumps. The vessel has a 70-foot boom crane to transfer pipe from the ship's pipe rack to the drilling platform. A helicopter flight deck is built over the forward end of the vessel.

Increasing interest in marine exploration also has had its effect on geophysical methods and equipment. An interesting development in this field has been the conversion of a former British naval vessel to service in marine surveying. Originally the corvette "Kingcup," it was recently acquired by Seismograph Service Ltd., renamed the "Seislim" and refitted for a new career of usefulness.

The main dimensions of the vessel are: length 205 feet, beam 33 feet and draft 16 feet, gross tonnage 1,035 and speed 17 knots.

The recording procedure installed is essentially the same as that employed on land, in that the reflections from an explosion are detected and recorded by seismometers, whose relative position to the point of explosion is known, and from this the depths of reflector or refractor are computed.

In carrying out these surveys, it is essential that the exact position of the ship should be known, the exact position of the exploding charge relative to the ship, and the exact position of the seismometers relative to the explosion point.

NO MOUNTAINS TOO HIGH .....

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..... SCHLUMBERGER GOES !

New Houdry Iso-Plus Process Reforms Low-Octane Naphthas Into 100-Octane Plus Gasoline

The new Houdry Iso-Plus Process reforms run-of-the-refinery low-octane naphthas into gasolines with octane ratings as high as 108-octane F-1 clear.

Conversion rates are extremely high. Variations of the Iso-Plus Process yield from 86% to 91% of naphtha charge stock into 100 octane gasoline. Up to 82% of the charge stock can be converted to 108 F-1 clear octane gasoline for blending with refinery pool gasolines of lower anti-knock ratings.

The development of Houdry Iso-Plus gives refiners a conclusive answer to the present high octane derby. With 300 h.p. automobile engines predicted for 1960, refiners are now planning their process facilities for the economical production of suitable fuels. Houdry Iso-Plus, already extensively tested in the pilot stage, can meet all high-octane requirements of the foreseeable future.

For further information, write to Houdry Process Corporation, 1528 Walnut Street, Philadelphia 2, Pennsylvania.

HOUDRY PROCESS CORPORATION

PIONEER IN CATALYTIC PROCESSES

Crane lifts a section of steel templet for a drilling platform being built by Higgins of New Orleans for the California Company.

This Christmas tree at sea marks one of Shell's producing wells offshore. Here a sea-going gager inspects the arrangements of pipes and valves.

Converted British corvette "Seislim" made fast to buoys in the Thames Estuary prior to loading explosives for her first seismic assignment.

The positioning of the ship is by means of "Lorac," an electronic phase system, with two fixed land points.

There are two explosion cables, port and starboard of the ship, which are insulated except at the firing point at the end. The explosive charge, attached to a cable of predetermined depth, is run along this cable by means of a ring which forms a contact with the bare end of the cable, so that at the required time the charge can be exploded electrically.

In the center of the vessel at the stern is the cable carrying the seismometers, spaced out at the distances and in the number required. At the time of firing the ship is under way, and in order to maintain the position of the seismometers relative to the explosion point, the cable carrying the seismometers is played out at exactly the same speed as that of the ship.

The reflections or refractions from the explosions are amplified and recorded on charts in the instrument room. From these charts the geophysicist can construct a contour map of the submarine rocks.

As time is an essential factor in these operations, and also as the vessel has to remain at sea for long periods to take advantage of weather conditions suitable for recording, she has been fitted with a heliport at her stern, so that a helicopter can be employed for carrying the charts ashore and for conveying essential stores to the ship.

As complete coverage of an interesting area is necessary, recordings may have to be made over shallow waters, and for this purpose the "Seislim" carries two shallow draft 100 hp diesel motor launches, fitted up in a manner similar to the mother ship.

A large amount of explosives must be carried, so the ship is fitted with two magazines, one of which will hold 75,000 pounds of high explosive and the other 16,500 detonators.

The ship is fully air-conditioned so as to be able to operate in any climate, her destination on her first voyage being Singapore, and her first assignment will be in waters off territories forming part of the British Commonwealth.

American oil operators have demonstrated their faith in the future of submarine drilling by paying hundreds of millions of dollars in bonuses for concessions covering offshore exploration and exploitation. One sale of concessionary rights by the federal government of the United States held in October 1954 and applying to less than five percent of the area under national control in the Gulf brought bids of over $115 million. These were all locations in the continental shelf region, lying well beyond the limits of state authority and including tracts as much as 50 miles offshore and in waters of 80 to 125 feet depth. Other sales conducted by coast-wise states, limited to waters lying within their areas of undisputed control, have brought an equal response with bonus offers running to hundreds of millions of dollars. While the amount of marine exploration done thus far affords only a sketchy basis for calculation of the total deposits that may lie underwater, some experienced geologists have hazarded estimates that these may add 50,000 million barrels to the potential reserves of the United States alone.

Other governments, awakening to the possibilities of finding petroleum within the continental shelf areas around their own coast lines, have entered into agreements for exploration and exploitation of such areas. As a result, marine surveys and drilling tests are under way or in contemplation at several points in the Persian Gulf area, near Borneo in the Pacific, in coastal waters of Trinidad and Peru in South America and offshore in Germany and the Netherlands in Europe.

The ultimate effect of marine exploration upon the development and supply of the world's petroleum remains for future determination, but the evidence already at hand indicates that the answer to the question will be pursued with the same energy and unrestricted expenditure of vast funds that has characterized the search for oil throughout past decades.

Commander J. Y. Cousteau, famous underwater "explorer," has been commissioned by the D'Arcy Exploration Co., prospecting subsidiary of British Petroleum Co. Ltd., to investigate the waters off Abu Dhabi in the Persian Gulf.

First of its type to be built and equipped in Britain, this barge will be used in conjunction with a permanent drilling platform to drill to depths of 15,000 feet in Venezuela's Lake Maracaibo.

R. E. McMillen, author of the accompanying analysis of the Venezuelan oil industry, is a native of the State of Minnesota, U.S.A. He graduated from the University of Minnesota in 1939 with the degree of Engineer of Mines in Geology. His first employment was with the Seismograph Service Company in the Mid-Continent region of the United States. He was transferred to Venezuela as seismic supervisor of the company in 1944. In 1947 he joined Phillips Petroleum Company as a geophysical supervisor in Venezuela, becoming chief geophysicist in 1949 and assistant manager of exploration in 1950, a position which he held until 1953 when he resigned to return to the United States. Since then he has been chief geophysicist of Midstates Oil Corporation of Tulsa, Okla.

BASIC ASPECTS

Venezuela is the second best customer of the United States on a per capita basis, according to a recent survey by Economic Specialists, Inc. Canada is first. In 1950 the United States exported goods worth $900 million to Venezuela. The ports of New York and Baltimore handled more than $300 million worth of goods for Venezuela. Goods shipped last year were manufactured by 1,350 companies in 750 communities. Exports to Venezuela are made possible largely by that country's oil production. The survey was sponsored by Creole Petroleum Corporation, largest producer in Venezuela.

FOR MANY YEARS Venezuela has been cited as an outstanding example of industrial progress resulting from active development of her natural resources. An abundance of such resources, together with favorable legislation and adequate capital, characterize the Venezuelan oil industry. The resulting development has prompted the usage of superlatives in describing the industry and the country. Consideration of some general statistics demonstrates the direct relationship between the oil industry and the extensive industrial progress of recent years.

The year 1954 marked the fortieth anniversary of the discovery of oil in commercial quantities in Venezuela. On July 31, 1914 the Caribbean Petroleum Company, an affiliate of Barber Asphalt which was acquired by Shell in 1916, completed its Zumaque No. 1 well at the modest rate of 250 barrels per day. The successful completion of this well prompted active development of the Mene Grande field which, after over forty years of development, still produces about three percent of the current production of all Venezuela. Total accumulated production of over 400 million barrels, equal to some 40,000 barrels per acre, had been produced from the Mene Grande field as of December 31, 1953.

Discovery of Mene Grande along the eastern shore of Lake Maracaibo led to exploratory drilling in various localities around the lake. Several commercial fields were discovered, but it was not until late in 1922, when Shell's R-4 well blew out, making an estimated 100,000 barrels per day, that the importance of Venezuela as an oil producing country be-

From an address before the Tulsa Geological Society December 20, 1954, published in *Venezuela Up-to-date*.

# of Venezuela's oil industry

came evident. It was this event that provided the stimulus for an extensive oil search throughout the country.

Intensive drilling along the eastern shores of Lake Maracaibo has led to the discovery of several oilfields which rank with the best in the world. The Bolivar Coastal district covers an area encompassing fields which were originally thought to be entirely separate but now are accepted as being parts of one great oilfield. The fields straddle the eastern shore of the lake for some fifty miles from northwest to southeast, the width varying considerably and reaching a maximum of about fifteen miles in the central part.

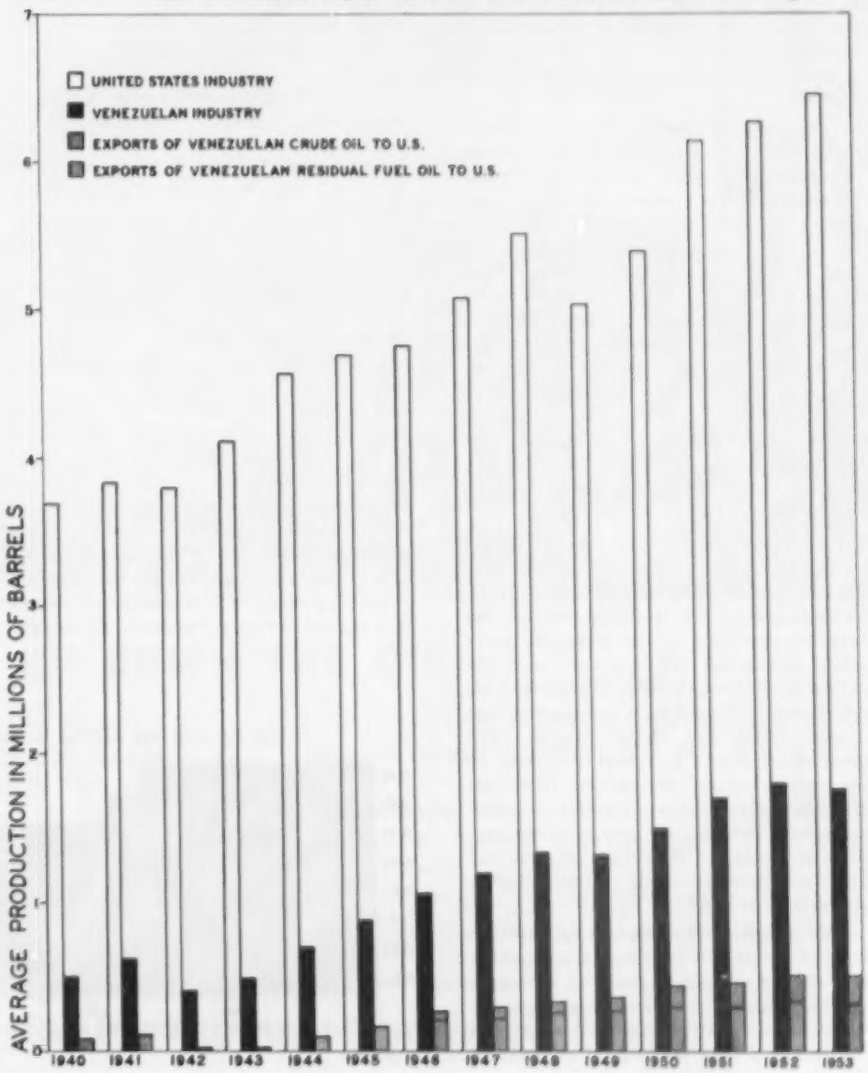
Recoveries from one of these fields, Lagunillas, exceed 90,000 barrels per acre. After twenty-eight years of development, the limits of the field have not yet been fully defined.

Results obtained in other parts of Venezuela have been somewhat less impressive than those registered in the Maracaibo basin. However, production has been substantial, for the accumulated average recovery amounted to 11,105 barrels per acre on all proven acreage in Venezuela as of January 1, 1952. Daily production in the United States was between 11 and 13 barrels per well during the immediate post-war years. By comparison, production in Venezuela ranged from 210 to 225 barrels per well per day during the same period. Current average daily production is about 150 barrels per well. Proven reserves in Venezuela are estimated to be over 10 billion barrels as compared to some 32 billion barrels in the United States. Thus Venezuela has approximately 22 percent of the proven reserves of the western hemisphere and 12 percent of the world total.

Venezuela is second only to the United

(Continued on page 140)

CRUDE OIL PRODUCTION, UNITED STATES AND VENEZUELA: 1940-53 *Figure 1.*



Venezuela *(Continued from page 139)*

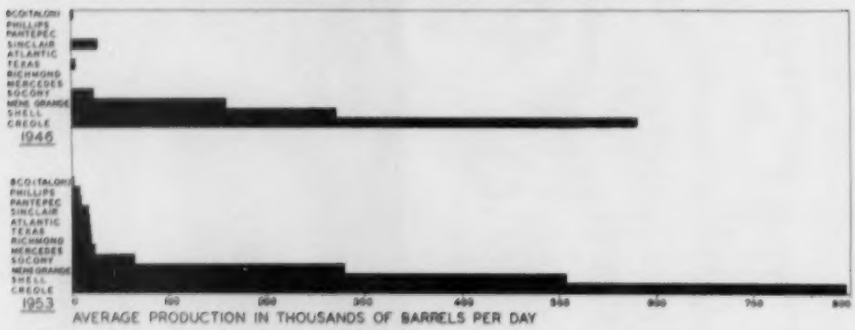


Figure 2.

States in the world oil production, a position it has maintained since early 1944. In the matter of exports it ranks first. Exports of crude and products averaged 95 percent of total production during recent years, a volume which represents some 40 percent of all oil in international trade. During the year 1953 Venezuelan oilfields furnished 54 percent of all crude oil and related products imported into the United States.

A measure of the success of oil search in Venezuela is shown in Figure 1. Average daily production rates of the United States and Venezuelan industries are shown for the years 1940 through 1953. In addition, exports of crude and residual fuel oil from Venezuela to the United States are shown for the years in which reliable data are available. Crude oil production in Venezuela rose from 54,000 barrels per day to 1,765,000 barrels per day in the period 1925-1953, while United States production rose from 2,092,000 to 6,459,000 barrels per day. During this same period the exports of crude and residual fuel oil to the United States rose from 4,000 to 502,000 barrels per day.

It is evident that the Venezuelan oil industry has made its greatest strides during the period following World War II. Reliable production statistics showing the progress recorded by the principal operating companies are available for the period 1946 through 1953. These statistics are shown in Figure 2. It is apparent that Creole, Shell and Mene Grande have maintained their dominant positions in the industry over this period. However, it is also evident that a number of other companies which, for various reasons, were producing little or no oil in 1946 had stabilized their positions in the industry by the end of 1953.

This marked increase in production from 1946 through 1953 was accompanied by a corresponding increase in net capital investment in the Venezuelan industry as evidenced by the statistics shown in Figure 3. In 1946 net capital investment in the industry was $808 million. By the end of 1953 this figure had risen to $2,790 million. With the exception of the Caracas Petroleum Company and the Shell organization, all of the producing companies now active in Venezuela represent United States capital. It is evident that investments of the United States oil companies in Venezuela are very considerable.

Heavy world demand during the period immediately following World War II and the unexpected impetus of the Korean conflict no doubt had a considerable effect upon this overall expansion in the Venezuelan industry. However, it is generally accepted that the industry would not have reached its present level of productivity or degree of diversification were it not for the enactment of the Law of Hydrocarbons of 1943 by Venezuelan government. This law incorporated provisions of earlier petroleum laws, eradicated many conflicts from previously existing legislation and thus provided a political environment which encouraged extensive investment of outside capital. Venezuela has had its share of political turbulence through the years as various regimes rose to power. Despite the conflict of ideas represented in these various political groups, it is a matter of record that the oil industry continued to operate in accordance with the laws of the nation.

The general prosperity of Venezuela depends to a very great extent on its oil, which constitutes the greatest single source of wealth of the country. Petroleum and petroleum products represent 98 percent of the value of all exports. From this it is obvious that oil provides the majority of the foreign exchange with which Venezuela buys products and services in the world markets. Further, revenue from oil activities amounts to approximately 65 percent of the total revenue of the government. An idea of the quantity of money channeled into the Venezuelan economy through oil company operations can be gained from a brief analysis of the activities of Creole Petroleum Corporation during the year 1953. Total wages and related benefits paid out during the year to some 14,600 employees amounted to $91,621,000. Payments in royalties, income taxes and other fees to the Venezuelan government totaled $232,454,000. Net profit of the company was $228,997,000. Obviously, the operations of the entire oil industry in Venezuela result in the circulation of very large amounts of money.

During the depression of the early 1930's, when the oil industry was just coming into prominence in Venezuela, the government paid off all of its foreign debts. Today it still has no external debt and virtually no internal debt. Furthermore, it operates on a balanced budget year after year and has a gold reserve of some $350 million. The net result is that the United States dollar is really soft currency in Venezuela.

Despite the strength of the Venezuelan economy, government officials have recognized the shortcomings of a one-product economy for some time; in fact, since the depression days of the 1930's. At that time the idea of "sembrar el petroleo," literally, "sowing the petroleum," was originated. A very considerable percentage of the economic expansion that has occurred in recent years and continues in various parts of the country is a direct result of that policy. One of the more ambitious projects that recently has been completed, and one that has re-

(Continued on page 142)

Figure 3.

BP SHIPS THE OIL

The British Tanker Company, shipping subsidiary of The British Petroleum Company Limited, operates one of the world's largest tanker fleets, shipping crude oil and products to refineries and markets in many countries.

There are fourteen BP refineries in Great Britain, Aden, Australia, France, Belgium, Italy, Germany and Israel. The latest, at Kwinana in Western Australia, came on stream in February, 1955, more than three months ahead of schedule.

The British Petroleum Company distributes and markets oil products both direct and through various associated companies.

Its prospecting subsidiary, the D'Arcy Exploration Company, is interested in oil-bearing territories in many parts of the world.

The Company's main research establishments are at Sunbury in Middlesex and at Kirklington in Nottinghamshire.

The BP Shield is the symbol of the world-wide organisation of

The British Petroleum Company Limited

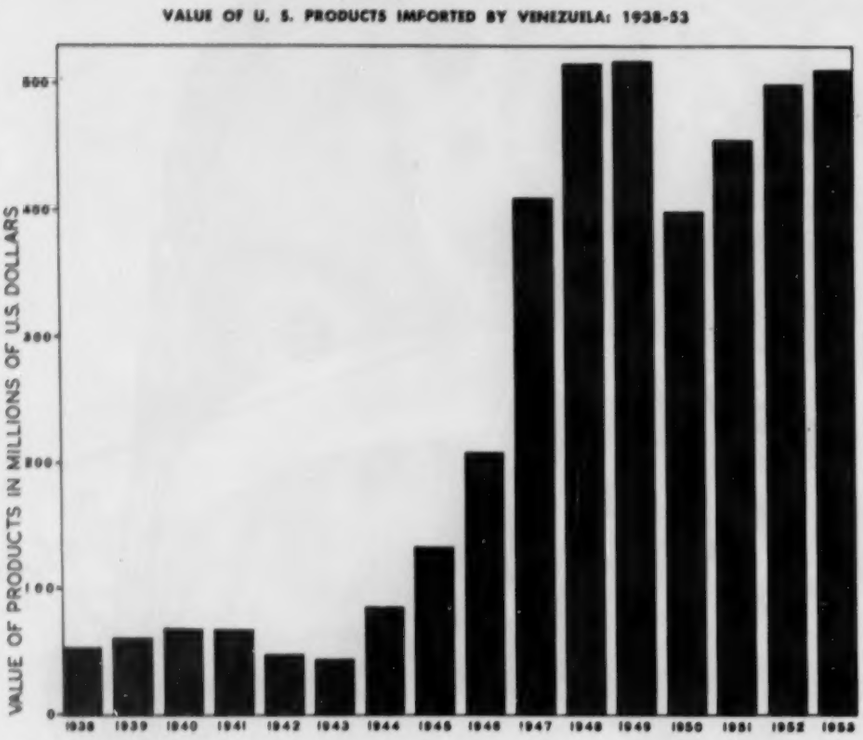


Figure 4.

ceived considerable publicity, is the $45 million highway from Caracas to the Caribbean seacoast. Other projects of even greater magnitude include an extensive highway system in the interior, a railroad network to be constructed over a period of several years, and establishment of steel production in connection with the fast-growing iron mining industry. These are but a few of the many projects that are being carried out. Others of lesser magnitude are in progress, some of which were in the "blue print" stage prior to World War II. It is interesting to note that several of these projects have weathered the changes in political regimes over the intervening years.

Numerous segments of the Venezuelan economy are directly dependent upon the continued stability of the oil industry. While only three percent of the total labor force is directly employed in the industry, approximately 25 percent of the total national income is derived from oil industry operations. Under present plans the iron mining industry of Venezuela will eventually furnish some 12 percent of the iron ore requirements of the United States steel industry. Over the years the development of iron mining properties is certain to have a marked effect on the Venezuelan economy. When the potential effects of this development

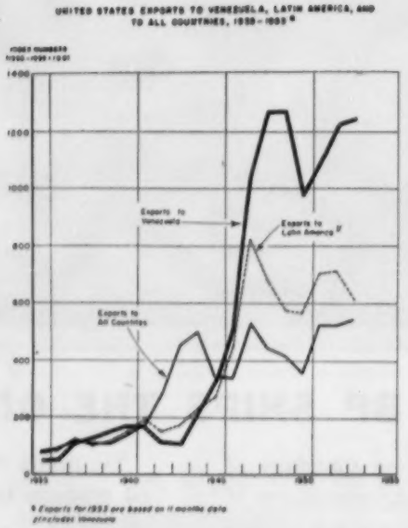

UNITED STATES EXPORTS TO VENEZUELA, LATIN AMERICA, AND TO ALL COUNTRIES, 1938-1953
Exports to Venezuela
Exports to Latin America
Exports to All Countries

Figure 5.

are considered in the light of industrial progress recorded to date from the effects of the oil industry, it is not difficult to visualize a long period of steady expansion in the economic structure of Venezuela.

Indirectly, United States industry is affected by the health of the Venezuelan economy. Figure 4 illustrates this story in part. Value of all United States products exported to Venezuela totaled slightly over $52 million in 1938. In 1953, value of these products was over $511 million. In addition to the value of products included in the chart, the invisible exports to Venezuela amounted to some $370 million in 1952. No accurate statistics are available for the year 1953, but they no doubt equal or exceed the figure reached in 1952. Hence, total United States exports of goods and services to Venezuela are currently above $850 million yearly. In contrast, total value of Venezuelan exports to the United States, the majority of which of course is oil, are currently below $400 million yearly.

Comparative growth of United States exports for the period 1935-1953 is shown in Figure 5. It is evident that the rate of growth of exports to Venezuela is well above the average of the two major categories illustrated. In the Latin American market, where export trade of the United States has increased more rapidly than in other regions, Venezuela is the second best customer in total dollar volume, as shown in Figure 6. Moreover, on a per capita basis, Venezuela ranks as the best Latin American customer of the United States and is surpassed only by Canada in the world market. Comparative statistics on export business to selected countries is illustrated in Figure 7.

About 67 percent of all goods imported by Venezuela in 1953 originated in the United States. An economic survey completed in March 1954 shows that these goods and services are obtained from some 450 cities in 43 states. A breakdown of the various general categories of merchandise exported to Venezuela is illustrated in Figure 8. In addition, those exports classified as invisible include such items as air travel, insurance of various kinds, ocean freight, banking services, construction and similar engineering

(Continued on page 144)

Figure 6. U. S. exports to leading Latin American countries, average annual dollar volume, including re-exports: 1952-53. Estimated exports for 1953 are based on 11 months' data.

Solenoid-operated plunger pump with variable stroke and speed.

Single-stage gas pump with polytetrafluoro-ethylene diaphragm.

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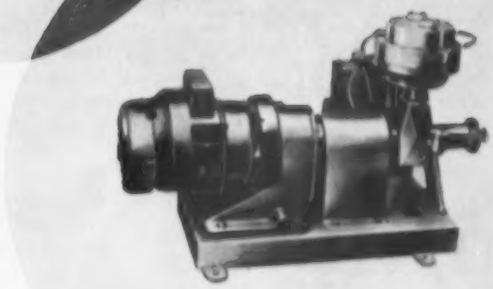

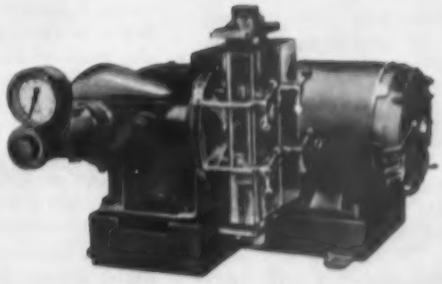

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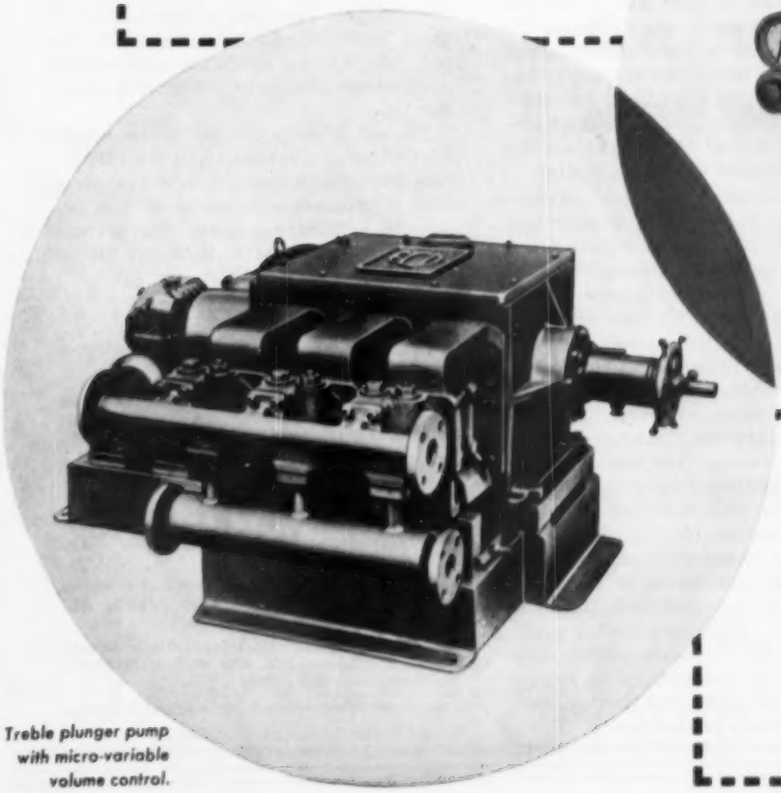

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Venezuela

(Continued from page 142)

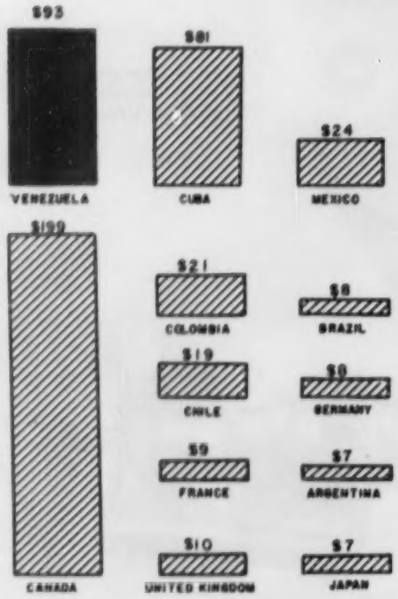

Figure 7. Per capita value of U.S. exports to selected countries, 1952-53. Average value per capita of population of importing country. Includes re-exports. Estimated exports for 1953 are based on 11 months' data.

services performed by United States companies in Venezuela.

The flow of Venezuelan oil to the United States has evoked criticism from various quarters for several years. This criticism has been severe at times, despite the fact that Venezuelan oil played a very important role in the fuel supplies of the Allied forces during World War II and again during the Korean conflict. If the United States wishes to draw upon Venezuela's oil in time of emergency, it is only logical that it should continue amicable relationships through reciprocal trade during peace time. The oil industry in Venezuela is far too extensive and complicated an operation to be turned on and off at a moment's notice even if this were acceptable from the diplomatic standpoint.

Throughout the debate over the oil import question, much of the argument has concerned the relative need for importing oil to meet United States demand. Extensive verbiage has been devoted to discussion of the independent operator versus the large company and United States domestic supplies as opposed to imports. No one denies the need for a healthy domestic industry. However, in the heat of argument too little consideration has been given to the effects any restrictive action would have upon the countries from which oil is imported.

The aforementioned statistics on the economy of Venezuela show the balance of trade to be in favor of the United States at a ratio of about two to one. This condition deserves serious thought when considering the very important problem of oil imports. Drastic restrictions which would upset the economic balance in Venezuela could result in a very real effect upon portions of United States economy. Venezuela is a cash customer for many products and, as such, enjoys the position of not being indebted to the United States. This is a rather unique position in the world of 1955.

While the current drive for restriction of oil imports through legislation has not been directed specifically against Venezuela, it would be ironic indeed if legislation were enacted which would have the greatest effect upon one of the nation's best customers. Furthermore, the economic stability of Venezuela, in which the oil industry has served as catalyst, has become a symbol to other Latin American countries of the economic stature attainable by development of natural resources through investment of outside capital.

All of the so-called "Big Five" oil companies operate in Venezuela. It is evident from statistics illustrated in Figure 2 that two of these companies, Creole (Standard of New Jersey) and Mene Grande (Gulf), have a sizable stake in Venezuelan operations. These two companies, together with Shell, account for about 90 percent of the oil produced by Venezuela. For many years Venezuelan government officials have recognized the severe shortcomings of a one-product economy and have taken definite action to encourage development of other industries. In recent years considerable evidence indicates that the Venezuelan officials have become increasingly aware of the basic shortcomings of the concentrated control of its industry. While the leading position occupied by three companies does not constitute a monopoly, it is recognized that more diversified participation would have certain advantages.

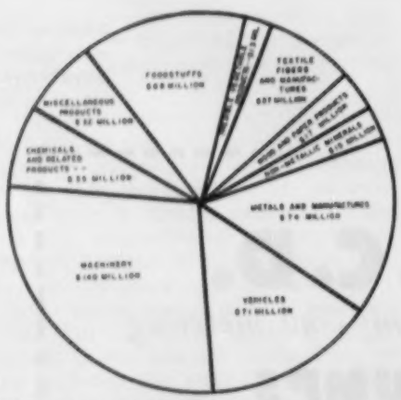

Figure 8. U.S. merchandise exports to Venezuela in millions of dollars, 1952-53. Estimated exports for 1953 are based on 11 months' data.

ACREAGE UNDER CONCESSION IN VENEZUELA
(as of January 1, 1952)

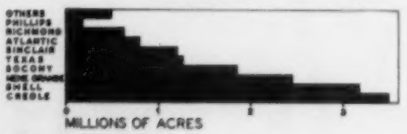

Figure 9.

At various times during the past year news reports have indicated that Venezuelan officials plan to grant new exploration concessions in the near future. No concessions have been granted since 1945 and the areas held by the various companies have decreased each year as parcellation and renouncement occurred. Figure 9 shows the acreage situation as of January 1, 1952. Little change has occurred since that date although some small areas have been condemned and the acreage renounced.

When new oil concessions are granted in Venezuela it will be done, without question, in keeping with sound business principles. The matter concerns the basic economy of the nation and as such deserves a carefully considered approach. The independent, small company and the majors will all have equal opportunity to make their proposals known to the Venezuelan authorities. The basis upon which new concessions are granted will no doubt differ, in accordance with terms of the various propositions. One aspect appears certain: new concessions will be granted only to legitimate companies and individuals who intend to integrate their operations into the economic structure of the country. The "get in now and get it quick" approach of some companies in the past has not met with the approval of government officials or the general populace.

The oil industry is vital to the industrialization of Venezuela and must therefore continue to operate on a long term basis if progress is to continue. The expansion of business under this precept can prove beneficial to both the United States and Venezuela.

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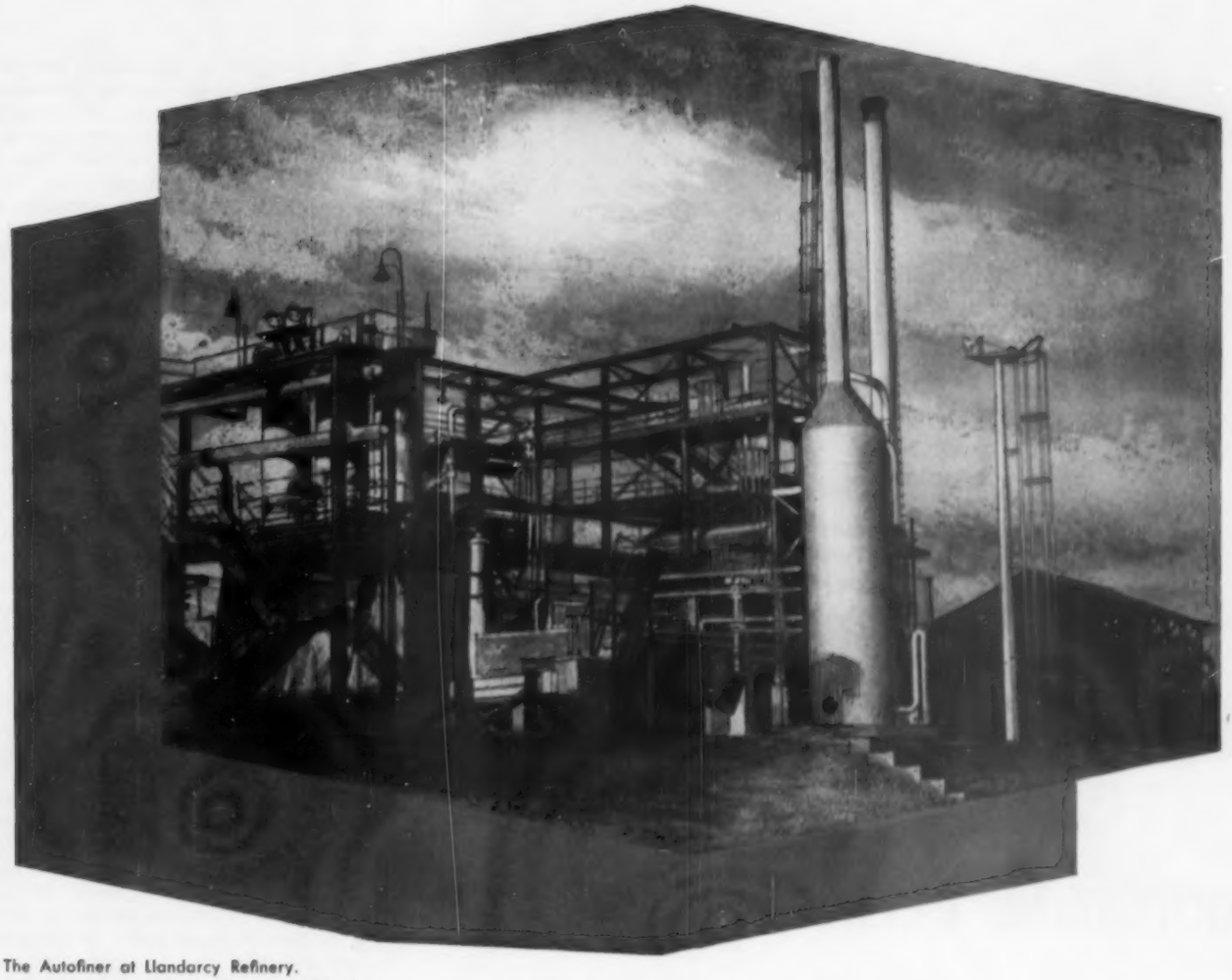

The Autofiner at Llandarcy Refinery.
Illustration by courtesy of the British Petroleum Company Limited.

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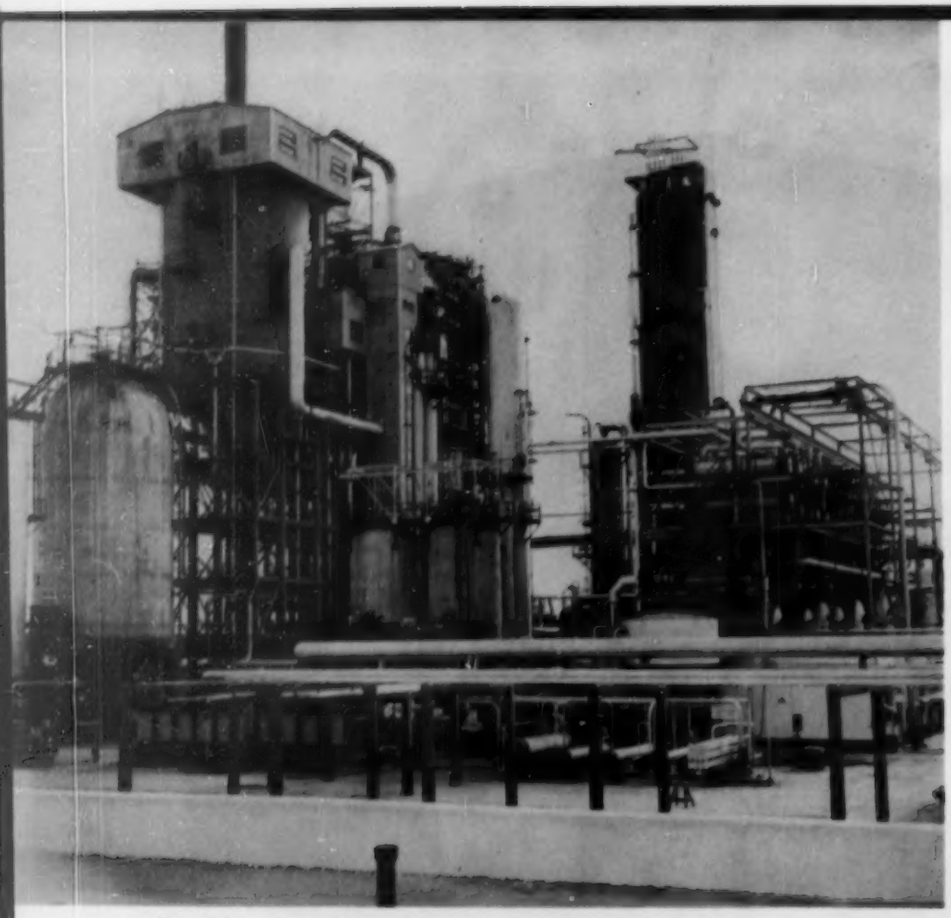

View of the cat cracker at Argentina's Eva Peron refinery. Photos courtesy M. W. Kellogg Co.

ARGENTINE PETROLEUM PROBLEM: Present and Future

By Bernardo Rikles

As is made clear in the accompanying analysis, the position of the Republic of Argentina in international trade is made difficult by the necessity of importing roundly sixty percent of its annual requirements of petroleum involving payments of some $100 million in foreign exchange. It is significant, therefore, that since this paper was prepared a definite effort has been made to bring about a substantial increase in the country's domestic production of oil and gas through cooperation between the national government and private capital represented by international oil companies and investment firms.

The first concrete step in this direction was the signing late in April in the offices of the state oil company YPF of an agreement between the Minister of Industry and Commerce, Orlando Santos, and Owen J. Haynes, representing Standard Oil Company of California, for organization of a new company, California-Argentina de Petroleos S.A. By the terms of this arrangement the company will make an investment of at least $13,500,000 and in return will receive a permit to carry on geophysical surveys and conduct drilling in an area of the State of Santa Cruz lying between the Argentine-Chilean border and the Santa Cruz and Gallegos Rivers. The investment specified for the company is understood to be regarded as a minimum which may be increased if the indications of preliminary surveys and drilling are considered to justify it. The contract is subject to approval by President Peron and confirmation by the Argentine Congress. In the event that oil is found in commercial quantities as a result of exploration, net profits are to be shared equally between the company and the government.

The agreement is the result of negotiations extending over the past six months and will mark the first entry of California Standard into Argentina. Similar negotiations are understood to be under way with Standard Oil Co. (N.J.) and Shell, both of which are now operating in Argentina.

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AN ANALYSIS of Argentina's petroleum problem entails a survey of its energy resources. The petroleum and natural gas consumption in recent years represents about 65 percent of the total fuel and hydroelectric energy consumption. In the second Five Year Plan, the petroleum and natural gas consumption is given at 56 percent of the national energy production anticipated for 1957, which has been estimated as equivalent to 14 million tons of petroleum.

According to the United Nations' Statistical Yearbook for 1952, Argentina's energy consumption in 1951, exclusive of vegetable and derivative fuels, was equivalent to 10.25 million tons of petroleum. In that year, Argentina had a population of 17.6 million inhabitants; therefore, the consumption was equivalent to 0.58 ton of petroleum per capita per year. Since the vegetable and derivative fuels, taken as the equivalent in petroleum, normally represent from 20 to 25 percent of total consumption, the 1951 energy consumption can be estimated at 0.77 ton of petroleum per capita.

If we take the population census of 1953, plus the average annual increase in recent years, we should have a population in 1957 of about 20 million inhabitants.

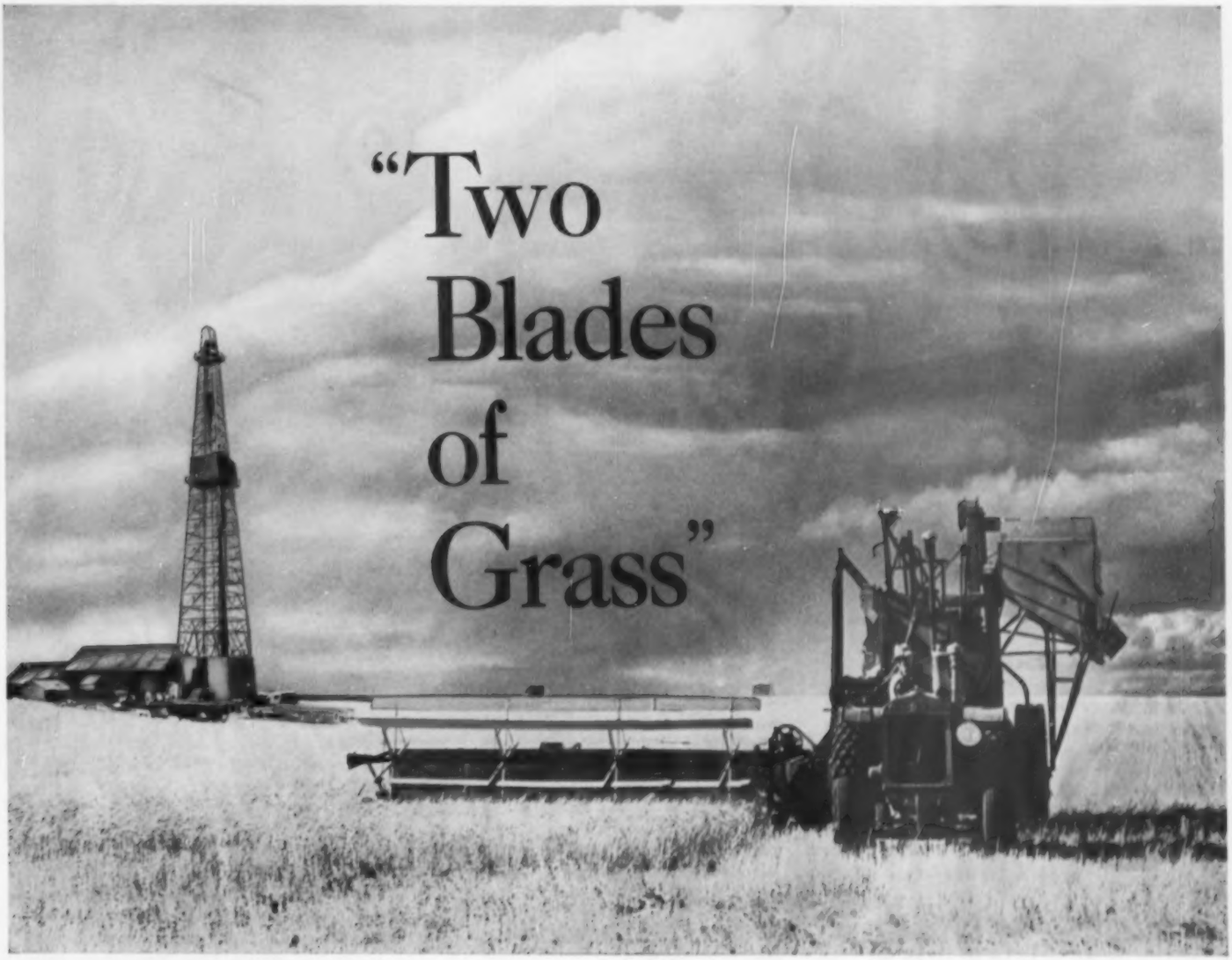
If the industrial, transportation, farm mechanization and other programs under the second Five Year Plan are carried out, the energy consumption, which has been showing a rising tendency since the war, might reach by 1957 the equivalent of 0.9 ton of petroleum per capita. We may expect for that year an energy demand equivalent to 18 million tons of petroleum.

These figures agree with the predictions made in various studies of the energy consumption by the different economic activities of the country as well as of the long range increase in consumption of liquid fuels, coal, vegetable fuels and electric energy.

Argentina's energy consumption averages about 90 percent of its available fuels and hydroelectric energy (national and imported). This is due to differences in stocks and to small unrecorded consumption, and particularly to losses in storage, transportation and handling.

Therefore, to meet the anticipated consumption of 18 million tons in 1957, the country should have available the equivalent of 20 million tons of petroleum. This represents a deficit of about six million tons with respect to the production schedule in the second Five Year Plan.

A review of Argentina's energy balances indicates that the consumption of vegetable fuels and derivatives in periods of normal activity works out to the equivalent of about four million tons of petroleum per year. The nature of these fuels makes their rational use possible only in the areas where they are produced; the tendency to divert to industrial use vegetable residues in ever-increasing quantities, and the reforestation potential with combustible species in



TWO CENTURIES ago Voltaire said, "He who makes two blades of grass grow in place of one renders a service to the State." The job of Standard Oil Company (New Jersey) and its affiliates is something like that – to produce oil where none was produced before and, by so doing, to create wealth for everybody.

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All these things helped the people and strengthened the nations where we do business.

Some highlights of these activities, drawn from the Annual Report, are set forth here as a matter of public information.

1. During 1954, the free world used more oil than ever before. And oil is energy, which is basic to the world's progress.

2. To meet these needs, our affiliates produced and refined more oil than ever before in the Company's history. But additions to oil reserves were greater than the oil used.

3. We had vigorous competition everywhere. There is nothing like competition to bring you better products and service.

4. 1954 was our top year in sales, earnings, and dividends paid to owners.

5. During the year, we spent 764 million dollars for new equipment and for exploration. Since World War II, we have spent 5 billion dollars for the means to meet your future oil needs.

6. Research was productive. Our research affiliate obtained more patents on products and processes than any other oil company. In Linden, N. J., the first atomic laboratory in the oil industry is being built to study the uses of radiation in oil refining.

7. Current developments in atomic energy will mean greater availability of electric power: increased mechanization, expanded industry, and greater use of petroleum products. The oil business will gain, and you will have the benefits of both kinds of energy.

8. We played an important part in arranging to return Iran's oil to world markets.

9. A world's safety record for major refineries was set by Esso employees at Baton Rouge, La. . . . 7,911,769 man-hours with no disabling injury. This passed the previous record by more than a million man-hours.

10. We have long supported education through our taxes. We have also felt an obligation to aid privately supported colleges and universities, which are an important source of new employees and of informed citizens. During 1954, we contributed about a million dollars to such institutions.

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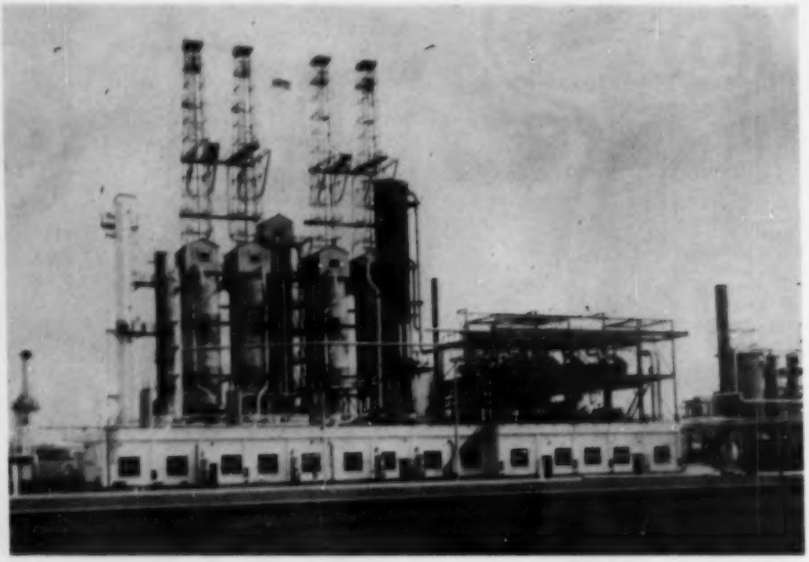
areas where the demand makes this enterprise economical, leads one to think that the annual consumption of these fuels will be maintained within the above figure for many years. Likewise, as the country's energy consumption increases, we should expect a proportional reduction in the supply of vegetable and derivative fuels.

It is thought, however, that within the next 10 years, the consumption of these fuels can be maintained within 20 percent of the total energy consumption.

According to the figures given in the *Boletín de Síntesis Estadística Mensual de la República Argentina* for July 1954, the production of coal in 1953 was less than in 1952. Assuming that it will not be possible to speed up the method of supply, which would require the expansion of the facilities for transporting and handling the coal from Río Turbio, a greater supply of energy from this source cannot be expected in 1957.

All this leads one to anticipate that the deficit, equivalent to six million tons of petroleum previously mentioned, might be even greater.

Assuming that Argentina continues importing coal at the rate of 1.2 million tons per year (about the same as in 1953), and bearing in mind that 1.5 tons of coal is equivalent to one ton of petroleum, it would be necessary to import in 1957 about 5.2 million tons of petroleum and derivatives. This, added to the national production of gas and petroleum, would represent 65 percent of consumption, leaving the greatest burden for the supply of these fuels to the country's energy resources.



Coking units at the Eva Peron refinery.

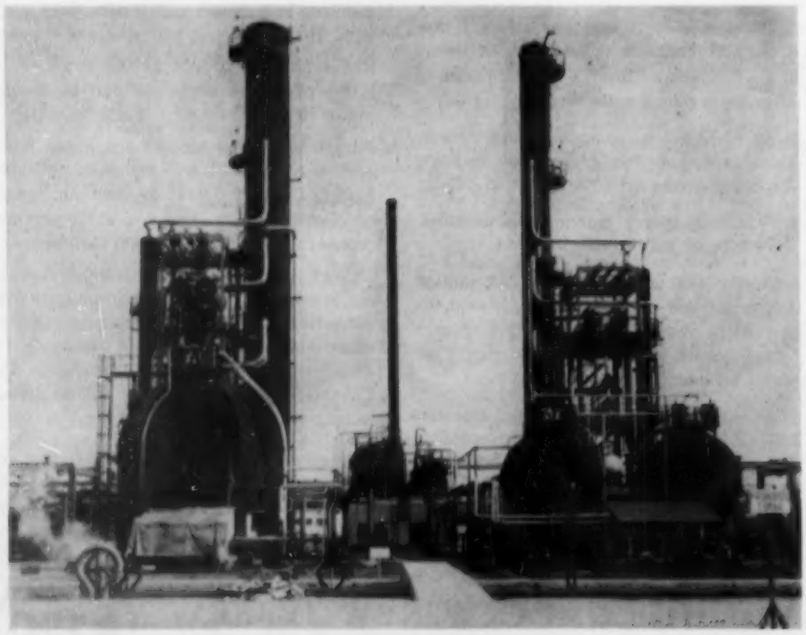
As will be seen from the above, the immediate solution of Argentina's energy problem requires that the 1953 petroleum production of four million tons be increased to over 11 million tons in 1957, instead of the six million tons contemplated in the second Five Year Plan. A seven-million-ton increase in petroleum production will bring it a proportional increase in the supply of natural gas, all of which will raise the energy balance.

In regard to the long range solution, preference should be given to the consumption of replenishable energy resources, which are represented by the energy produced by waterfalls, by tides and by vegetable and derivative fuels, by solar and wind energy, as well as by energy of nuclear fission (or atomic energy, as it is generally called), which must be included among the perishable energy resources.

Hydroelectric energy sources in Argentina have a potential capacity of 20 million kilowatts. The installations projected under the second Five Year Plan will amount to about 450,000 kw by 1957, or 2.25 percent of the country's hydroelectric power potential. The majority of the potential sources of hydroelectric energy are located far away from the principal centres of consumption; therefore, it will be necessary to create new industries in order to justify the installation of hydroelectric plants in southwestern Patagonia and the northern part of the country. The great length of the high tension transmission lines required to carry the electric energy to the industrial centers would make the cost too high for the consumer. Assuming, on the other hand, that new hydroelectric plants are installed every five years with a capacity equal to two percent of the country's hydroelectric energy potential, there would be an increase in energy supply equal to about 500,000 tons of petroleum per quinquennium.

If we assume a population increase in Argentina of about two million inhabitants every five years, and assume further that after 1960 the increased energy consumption per capita can be met with the vegetable and derivative fuels and other perishable energy and coal, which would require intense development of these re-

Another view of the Eva Peron refinery.



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sources, there would be an increase of above 2.5 million tons of petroleum every five years to meet future energy needs of the country and to replace the natural decrease in production by the country's oil fields.

In other words, the long range supply of energy, with the optimum rational utilization of the available sources of replenishable energy and fuels, means that the greater part must continue to be satisfied by petroleum.

Nobody doubts the petroleum producing potential of Argentina; in this respect, it enjoys a better position than some other countries that are endeavoring to give greater impetus to the improvement of their petroleum production potential.

Of the 3.2 million square kilometers of Argentine territory 1.7 million are sufficiently interesting to merit investigation. Of these, 700,000 square kilometers are suitable for direct geological research, and one million square kilometers for geophysical prospecting. It is understood that 500,000 square kilometers of the 700,000 mentioned have already been surveyed, and that geophysical studies have been made of 400,000 square kilometers of the million kilometers previously mentioned.

The oil reserves are estimated at about 120 million cubic meters. As pointed out several years ago by the President of Argentina, it is necessary to extract this crude oil, together with the gas generally found associated with it. Here is the nerve-racking aspect of Argentina's petroleum problem. Reduced to the simplest terms, when we consider the large number of locations for exploration wells that could be sunk on the bases of the geological and geophysical surveys conducted to date by Y.P.F., we might come to think that the problem could be solved by drilling a sufficient number of exploration and production wells. However, in spite of the great advances made in oil exploration technique, the wells have the last word about the presence of oil in the subsoil. In an interesting work published by Ing. J. J. Zunino in the *Boletín Informaciones Petroliferas de Y.P.F.*, it is stated that the determination of an oil-bearing zone requires the solution of seven unknowns, five of which can be answered satisfactorily only by sinking one or more wells.

In the United States, of the 13,313 exploration and probing wells drilled in 1953, 26 percent yielded oil, meaning that out of every five wells drilled only one turned out to be a producer.

In the case of exploration wells drilled in unknown zones, chosen solely on the basis of geological and geophysical surveys, the average success from 1944 to 1953 has been 11.4 percent, or one producer out of every nine wells drilled.

Of the exploration and probing wells drilled in Mexico in 1953, 27.6 percent were producers, and in Canada 28.8 percent. Argentina's success falls within these averages.

These figures offer a clear example of the risks taken in the search for new oil deposits, even with the aid of technical experts and modern instruments.

A drilling unit for prospecting work with all its equipment and auxiliary materials costs about $700,000. The length of time required to drill a prospecting well is much greater than for a production well, as it might take several months to a year or more. The amount of money that has to be spent before discovering a deposit of oil in a zone where the geological and geophysical surveys indicate the presence of structures and formations which might contain accumulations of oil generally adds up to several million dollars.

An important oil company, with a large staff of technical experts at its command, spent more than $25 million in Canada in prospecting work before locating a producing well in the Leduc oil deposit.

This brief digression on the risks involved in the search for new oil deposits and the large amount of capital required to obtain commercial production should not divert attention from the general problem under study.

To look for the solution of Argentina's petroleum problem in the simple idea of drilling a large number of wells in surveyed zones would be to complicate the problem in the future. The solution to the problem should be sought within the general energy supply plan of the country, taking into account all aspects of the petroleum industry, which has the greatest responsibility in the supplying of fuels.

The drilling of exploration and production wells should be followed by the geological and geophysical prospecting work required to locate new oil accumulations that may make it possible to increase the oil reserves and to compensate for the natural decline in production, which is generally estimated at 12 percent annually.

Likewise, along with the work required to increase oil and gas production and reserves should go the increase of transportation and storage facilities. In this respect, Argentina finds itself in a precarious position. National storage facilities can hold only two months' supply.

This lack of storage reduces flexibility in the operation of petroleum refineries, and occasionally results in a scarcity of the product, with consequent irregularity in the supply of liquid fuels.

At the same time, the country's crude oil processing capacity should be correspondingly increased, the present annual capacity being 10 million cubic meters (172,000 b/d). The equipment in nearly all the petroleum refineries in Argentina has been over 25 years in service, making it impossible to maintain a rational and integral operation, and leaving much to be desired in the economical consumption of fuel.

By rational and integral operation is meant the process which makes it possible to obtain from the crude oil the maximum yield in distilled fuels, especially of high octane naphtha for better utilization of its caloric energy in gasoline engines, and of lubricating oils with a high viscosity index.

The most modern refineries in the country were completed in 1941; this does not include the skimming plants installed at Eva Perón in 1950, nor the new refinery with a daily crude capacity of 4,500 cubic meters (28,550 b/d), equipped with a catalytic cracking and alkylation plant, capable of producing high octane naphthas, and scheduled to be completed at Eva Perón by the end of this year, nor the 400 cubic meter daily crude oil capacity plant inaugurated at Dock Sud last October to produce high viscosity index lubricating oils.

The development of the industry will not be complete unless distribution and marketing facilities are also increased. All of this must be accompanied by the training of capable technical personnel—quantitatively and qualitatively.

To obtain a seven million ton increase in crude oil production within the next five years, to compensate for the natural decline in producing wells, and to discover new oil deposits to make up for declining reserves, it would require intensive work and much more technical personnel than Argentina has at present. It would be necessary to drill about 1,100 producing wells annually (the exact number would depend on their production, which is estimated to be about 2,000 cubic meters annual average during the first five years of their existence). In addition, it would be necessary to drill about 200 exploration wells per year. The amount of drilling equipment and its cost would depend on the depth and geographical location of each oil deposit and other factors which need not be mentioned here.

To get an idea of the magnitude of the investment required, it will suffice to note that the investment estimated in the second Five Year Plan for a production increase of 2.5 million cubic meters of oil in five years amounts to 2.6 billion Argentine pesos.

It has been estimated that the development of the oil deposits discovered in northern Salta (Campo Durán and Madrajones), to transport the oil to San Lorenzo and the gas to Buenos Aires, would require an investment of about $200 million.

In recent years, Argentina's crude oil and derivatives imports have averaged about six million cubic meters per year. This represents payments in foreign exchange of more than $100 million per year. In this connection, it is interesting to note the information contained in *La Verdad Sobre el Petróleo Argentina*, a report published in 1949 by the Argentine Ministry of Industry and Commerce, which indicates that during the period from 1946 to 1949, the Y.P.F. spent millions of Argentine pesos in foreign ex-

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change, namely: 435 million in fuel imports, 234 million in materials for industrial plants (which includes the purchase of the new distillery known as *Juan Perón*, valued at $30 million), and 130 million pesos in ships.

The value of the fuels imported in 1949 represented 10.3 percent of the value of total imports. The importance of the foreign exchange spent on fuel imports fully justifies the investment required to increase crude oil production in Argentina, which is estimated to amount to more than $500 million during the next five years. J. Pogue estimates that the investment in the United States runs about $22,000 for each cubic meter of oil produced per day.

In view of the scarcity of foreign exchange, which constitutes a powerful factor in restraining the development of Argentina's petroleum industry, the magnitude of the investment, the risk involved in the search for new oil deposits, which requires large capital, the need to improve the country's foreign exchange balance and the need for an ample supply of fuel to maintain and give further impetus to industrial activities, the national government is justified in its negotiations looking to the discontinuance of the practice of confining the responsibility for development of the country's petroleum resources to one corporation only, notwithstanding the financial aid it received from the government and the highly efficient and capable technical personnel it commands.

In Peru, where the idea that the government should operate its oil fields exclusively prevailed for many years, a new petroleum law was adopted in 1952, giving national and foreign capital an opportunity to explore the country's territory in search of new oil deposits and to extract and process any crude oil they might find.

According to Argentine technologists and specialists in various branches of the petroleum industry, some occupying executive positions and others already retired, the new law (which replaces the 1937 law) is considered a very good measure. This legislation is the result of heated parliamentary and public debate, in which representative organizations of the country and the people participated through the press. The proposed law was prepared by the military government of Peru in 1948. As explained by President Odria in a speech delivered on the date the new law was promulgated, this legislation was requested by the military government upon observing the small increases in Peru's petroleum production while consumption was 50 percent in excess of production. The government felt that a continuance of the pace set in recent years would convert the country from an importer of petroleum to an exporter. It was also considered necessary to convert the country into an important exporter of petroleum in order to improve Peru's exchange balance.

President Odria's speech is considered edifying and constructive. In spite of the limited amount of space available, and passing up certain technical considerations concerning the rationalization of the use of fuels and the importance of modernizing Argentina's petroleum refineries in order to improve its energy and exchange balances, two thoughts are cited from this speech because they are considered applicable to Argentina: ". . . it has always been difficult to touch this point" (referring to petroleum legislation); "the solution has been postponed for many years because it presented serious difficulties, especially from a political point of view. Heretofore, we took the easiest way out, which was to delay the solution of the problem, leaving it for the future. This self-defeating policy has accomplished nothing but to retard the petroleum industry and the economic development of the country.

"I am convinced, therefore, just as undoubtedly are the greater majority of my countrymen, that it is necessary to take a realistic attitude toward our nationalism, which should be constructive instead of negative."

By the end of 1953, less than two years after the new law was promulgated, 12 private corporations, national and foreign (including two backed by Argentine capital), were operating in the Peruvian region known as the Sechura desert. Before the promulgation of the new law, the operation of this area was scheduled to be turned over to a private corporation. With the new law, the Empresa Fiscal de Petróleo, created in 1939, found itself (in spite of the facilities granted to private capital) reinforced and enlarged in its oil production operations.

One of the countries where the beneficial effect of private capital in the petroleum industry has been unquestionably demonstrated is Canada. In the western fertile plains of the country (Province of Alberta), with an area of 1,994,000 square kilometers, where over 90 percent of Canada's petroleum is produced and where a well has been drilled for every 460 square kilometers, there are about 240 oil companies in operation, which, according to the president of the Canadian Petroleum Association, spend one million dollars per day. This country's oil production has been increased by 11 million cubic meters in seven years, and its proven reserves by about 310 million cubic meters.

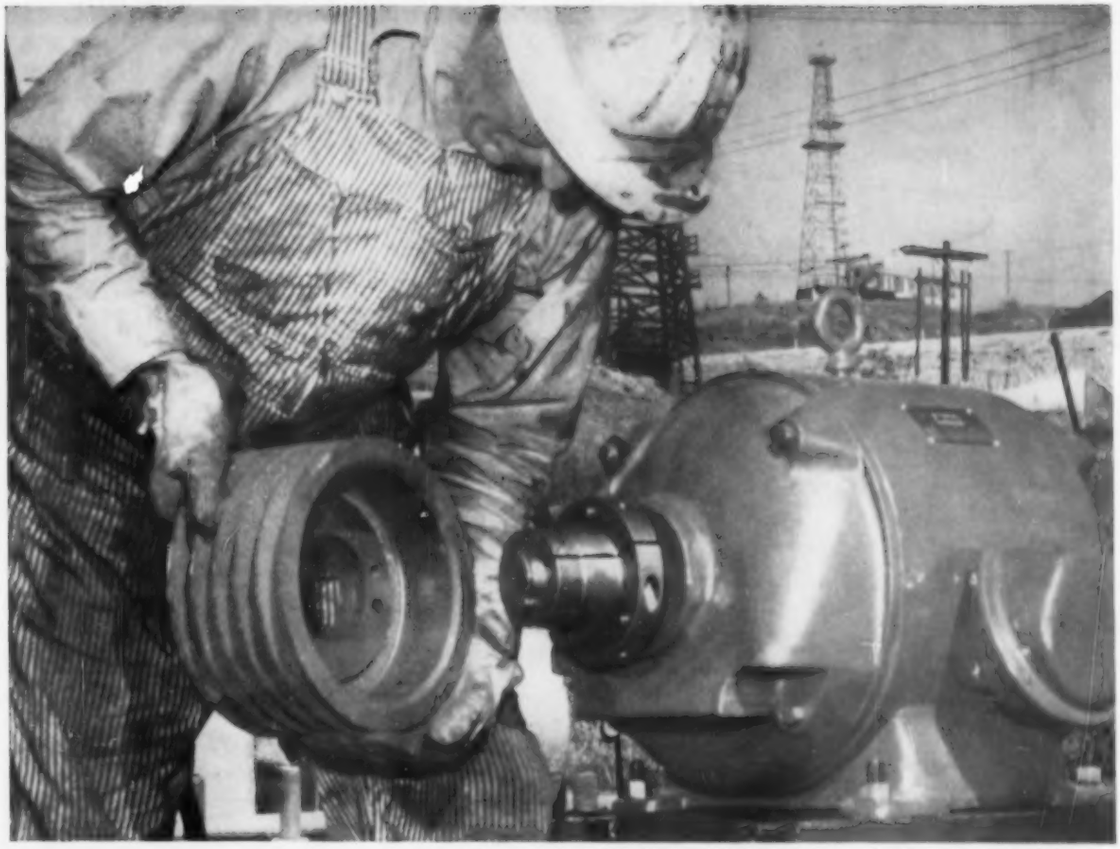
The petroleum industry has achieved enormous progress during the past thirty years; it can no longer be compared, as was done at the beginning of the century, with a game of luck, where an individual invests his money and, if he is lucky, gets it back twofold, and if he is unlucky, loses every penny. Today, every branch of the industry employs technical methods developed on scientific principles. The petroleum industry in the United States is counted among those which spend the greatest amount of money on technical and scientific research. This research is responsible for the development in recent years of the progressive petrochemical industry, which is turning out products that will increase the supply of foods and materials for construction, for clothing and shelter and for the health and welfare of mankind.

It may be of interest to mention here that Argentina's petrochemical industry is in the early stage. Several industrial enterprises plan to manufacture plastics, but since the petroleum industry is not in a position to supply the necessary raw material, such plans are based on the use of a costly product and high energy consumption. This places the petrochemical industry at a disadvantage, since its establishment on an uneconomical basis will make it impossible for domestic plastic products to compete favorably with those from other sources, which they should replace under normal circumstances. The high cost of production will not allow for full expansion in consumption of the finished products, thereby restricting the development of the industry, which in other countries has achieved the economical production of rubber, construction materials, articles for the home, textiles, detergents, pesticides, and many other products which contribute effectively to improve the standard of living.

Gone is the era of adventures in oil so eloquently described in *"The Black Golconda," "Oil for the Lamps of China"* and similar novels. In the United States there are 14,000 oil companies in operation (exclusive of those devoted to the sale and distribution of petroleum products), of which nearly 13,500 are engaged in the production of oil. Of the 47 oil companies whose shares are bought and sold in the country's exchanges, the capital assets of the smallest are valued at $5.6 million, and those of the largest one, with commercial and industrial activities all over the world, at $2,705 million. The capital of the former is represented by 281,000 shares and that of the latter by 60 million shares, with over 284,000 shareholders.

The development of the petroleum industry during the past century has been intensive and extensive in all its aspects, involving the technical, social and political fields.

The laws regulating Argentina's petroleum industry were enacted over 20 years ago. They cannot provide, therefore, for the realities of the moment. The foregoing analysis of the country's energy balance confirms the advisability of the change in petroleum policy which the Argentine government is now endeavoring to make. The full study and revision of the country's petroleum legislation would bring it in consonance with reality, would clarify the future of the industry, and would bring it in harmony with the industrial, economic and social progress which the second Five Year Plan proposes for the country.



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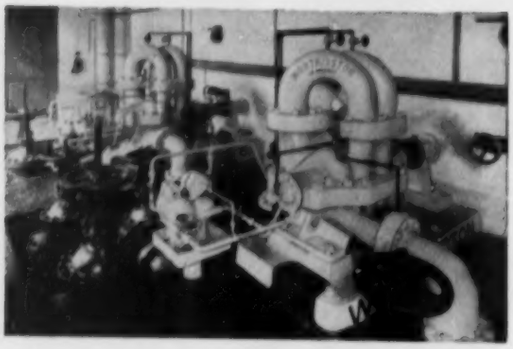
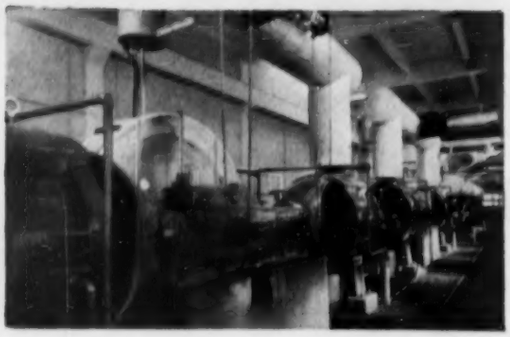
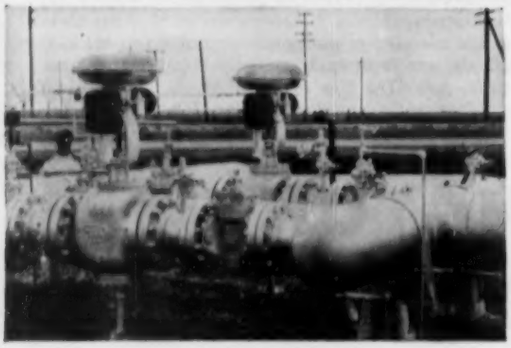


Vacuum pumps in a refinery



Pipe-line pumps



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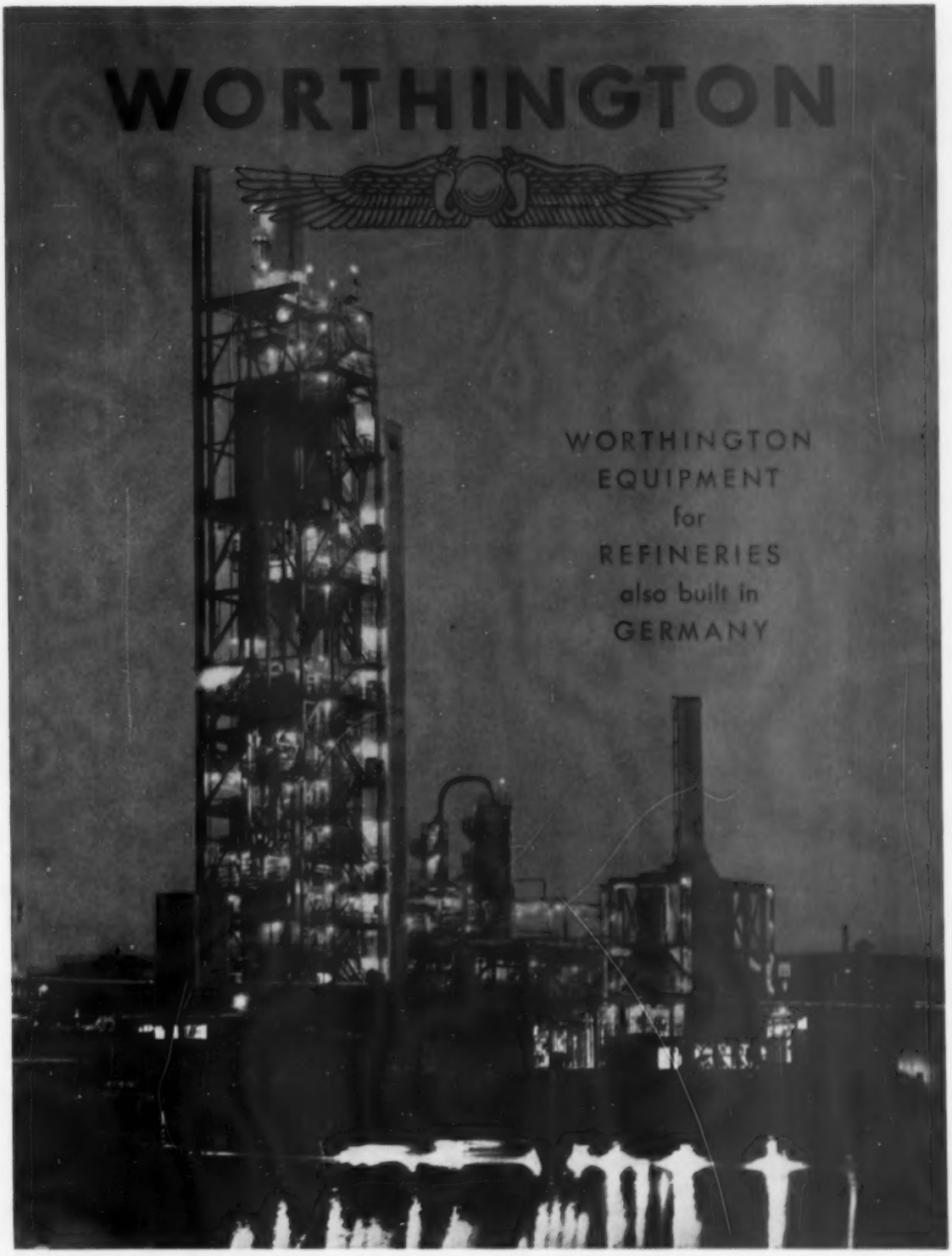

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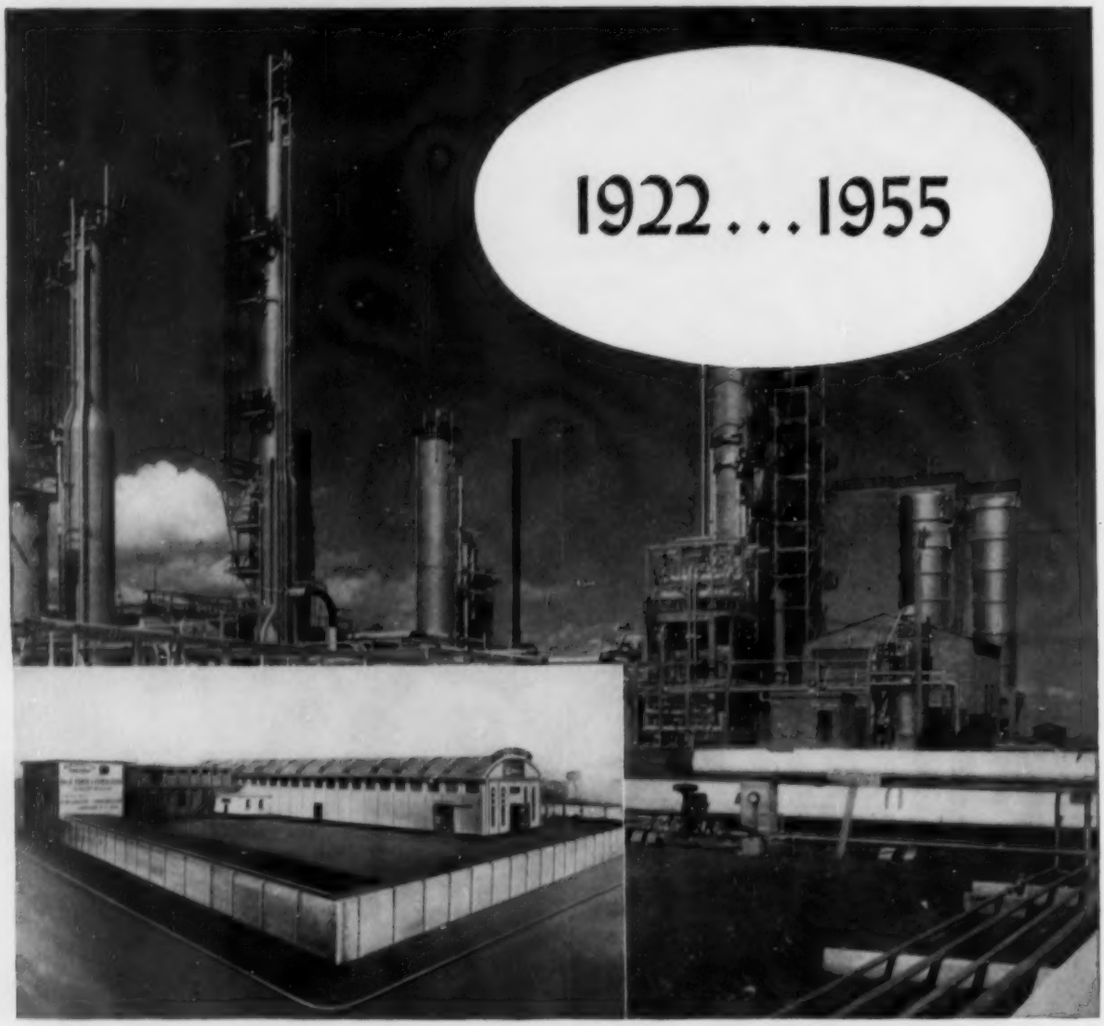

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TECHNICAL PROGRAM OF THE FOURTH WORLD CONGRESS

THE TECHNICAL PROGRAM of the Fourth World Petroleum Congress is divided into nine separate sections, each dealing with the activities of a particular division of the industry. The papers selected for presentation and discussion by these several panels have been collected through the efforts of the national committees of the thirty-four countries and political divisions affiliated with the Congress, acting under the direction of the Technical Committee of the General Organizing Committee of the Congress.

The Technical Committee is under the chairmanship of Prof. Carlo Padovani, director of the Stazione Sperimentale of Milan, and consists of twenty members including experts from the technical and research departments of the Italian oil companies and polytechnic schools, together with a staff of assistants. It had the onerous task of receiving, editing and translating papers, revising charts and tables to a uniform standard. When this had been done and the papers had been approved by the General Committee, it was necessary to have preprints prepared for distribution to delegates and to arrange schedules for the meetings of the different sections so that several groups could be meeting simultaneously. The work of preparing the technical program of the Congress has been going on continuously for the past two years, has enlisted the services of hundreds of oil men in different parts of the world and has involved a truly enormous amount of labor and effort.

Because of the great number of papers to be considered and the limited amount of time available, a vigorous schedule of regulations for dealing with papers has been set up and ingenious mechanical means of enforcing the established time limits have been installed. Authors of papers are limited to fifteen minutes for their presentation and therefore are not expected to read their manuscripts in full, but rather to bring out only the highlights and main points. Since printed copies are to be in the hands of all listeners, this will entail no hardship in understanding these addresses. Those who wish to participate in the discussion of papers must file advance requests with the clerk of the committee in charge and must limit their remarks to five minutes. To facilitate the observance of these requirements, the platforms in the meeting rooms are equipped with lights of various colors. At the beginning of an address a green light appears. As the expiration of the time period approaches, a warning yellow light flashes on, and when the allotted time is completed a red light signals its expiration. If this is not sufficient to stop the speaker, all lights can be automatically extinguished, leaving the hall in darkness.

This is a very effective measure and all speakers are warned in advance that the procedure will be called into play if necessary.

Morning and afternoon sessions of the technical sections are to be held on each week day from June 7 to June 15, except for June 9, which is a national holiday. Morning sessions extend from 9 AM to 12:30 PM, with a half hour break in midmorning and from 3:00 PM to 5:00 PM.

On four afternoons during the Congress lectures on subjects of general interest are to be delivered at plenary sessions. The speakers selected for these addresses and their subjects are:

Wednesday, June 8: P. T. Cox, chief geologist, British Petroleum Co. Ltd.: *Evolution of Oil Exploration.*

Friday, June 10: Prof. J. Jungers, University of Louvain: *Principles of Fundamental Research in the Design of Petrochemical Equipment.*

Monday, June 13: Prof. W. K. Lewis, Massachusetts Institute of Technology: *Energy Resources.*

Tuesday, June 14: Ing. E. Mattei, chairman, Ente Nazionale Idrocarburi: *The Development of the Natural Gas Industry in Italy.*

Proceedings of the Congress, including technical papers, discussions and conclusions, will be published in ten volumes, including one general volume. Copyright to this material has been assigned by the General Organizing Committee to the publisher, Carlo Colombo, Campo Marzio 74, Rome, by whose courtesy the condensed notices of papers prepared for presentation before the technical sessions are presented on the pages following.

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TECHNICAL PROGRAM OF THE FOURTH WORLD PETROLEUM CONGRESS

SECTION I
(GEOLOGY AND GEOPHYSICS)

● *Geological Characteristics of Venezuela*, by J. Dufour, Bataafsche Petroleum Mij.

A regional study of Late Mesozoic facies development in Venezuela and the northeastern corner of Colombia is helpful in outlining the continental framework of the Guiana Shield in the general Caribbean area. Particularly favorable conditions with regard to the preservation of Cretaceous oil source rocks are noticed in the Maracaibo block which is further characterized by its outstanding tectonic rigidity.

● *Petroleum in Western Canada*, by John F. Caley, Geological Surveys of Canada.

Western Canada currently contributes about 99 percent of Canada's yield. From a detailed description of the geological structure of this region evidence is given of prospective oil bearing territories. Different types of presently known reservoirs in Western Canada are surveyed with regard to their geological age and distribution. Canada's oil and natural gas reserves are evaluated in the light of present knowledge, and some indication is given on the results to be expected from future exploration.

● *Important Fractured Reservoirs in the United States*, by M. King Hubbert and David G. Willis, Shell Oil Co.

Cumulative oil production of the United States up to the end of 1952 was 45.5 billion barrels. Of this, an excess of 0.7 billion barrels or 1.5 percent was obtained from fractured reservoirs; and the ultimate production from these reservoirs will probably exceed 2.5 billion barrels. The most important fractured reservoirs in the United States are listed in the paper.

● *New Geological Studies Result in Discoveries of Large Gas and Oil Reserves From Salt Dome Structures in the Texas-Louisiana Gulf Coast*, by Michael T. Halbouty and George C. Hardin, Jr., Houston, Texas.

Although beds of Tertiary age in the Gulf Coast of Texas and Louisiana constitute one of the most prolific oil producing provinces in the world, there is an absence of large tectonic movements and little regional folding, and therefore the area does not have major structural features of great relief which characterize many other oil producing provinces. New thinking in subsurface geological studies of these salt domes has resulted in the discovery of many millions of barrels of oil and trillions of cubic feet of gas. These studies have become most important, and this paper reveals the approach to such studies and the results that can be obtained by exploring behind them.

● *Introduction to the Geologic Map of Venezuela*, by A. Schwarck Anglade, Ministerio De Minas e Hidrocarburos.

Paper to be circulated at the Congress.

● *Results of Studies of Oil Search in Sicily*, by E. Beneo, Servizio Geologico Italiano.

Sicily derives its geological structure from the way in which rigid and plastic masses come to rest with respect to each other when subjected to upward stress and the force of gravity. Recent drilling (Ragusa) has revealed the possibility of a pay area in a deep-seated part of the substratum (calcareous-dolomitic clastic rocks). The porous calcareous roof of the substratum, provided it is accessible through its top shield, offers a good mineral potential. Finally, if porous materials are present in sedimentary layers interbedded with clay strata, there is every probability of their representing oil-fields.

● *The Oil Possibilities in Greece*, by G. Aronis, K. Zaxhos.

No preprint available.

● *The Wealden Formation in the Netherlands*, by G. C. L. Sung, Nederlandse Aardole Mij.

Beds of two entirely different facies types in the Netherlands are considered as being of the same age as the Wealden formation of S. E. England. Typical lacustrine sediments occuring in the N.E. Netherland, which lithologically and palaeontoligically can be correlated with the German "Wealden" of the N. W. German basin as well as with the beds outcropping in the type locality of the Wealden in S.E. England. Fluviatile-deltaic deposits occurring in S.E. Netherlands must be attributed, at least in part, to the Wealden formation.

● *Oil Accumulation and the Jurassic System in Northwest Germany*, by K. Hoffman, W. Schott, Amt für Bodenforschung.

For a number of years the German crude oil industry in Northwest Germany has been aiming at finding oil accumulations from Jurassic sediments. Important connections between the distribution of these oil fields and both the extension and facies of the Northwest German Jurassic Basin have been established. Thus oil fields with oil from the Jurassic are mostly encountered in areas of strong subsidence and sedimentation within the Jurassic Basin (Chapter IV). To identify and form an opinion on these connections it proved necessary to investigate the expansion of the basin and its sedimentary thickness during the different Jurassic times (Chapter II). A short stratigraphic review (Chapter I) precedes Chapter II. The Jurassic reservoirs have been described separately.

● *Petroleum Possibilities of the Jurassic; French Problems.*

Symposium by a group of leading French technicians.

● *Discovery and Early Development of Parentis—Southwest France*, by R. Navarre, Inst. Française du Pétrole, Paris.

● *Oil Search in French North Africa*, by V. Houreq, Soc. des Pétroles d'Afrique Equatoriale Française.

The author presents the geological conditions as revealed by work in the French basins of the West Coast and particularly the Cameroon and Gabon basins. Moving to the East part of Africa, the author gives the same kind of account as regards Madagascar. In conclusion, he gives a summarized review of the sedimentary and structural conditions of the African basins and the main characteristics of their paleogeography.

● *Geology of the Cuanza Basin in Angola*, by G. Brognon, G. Verrier, Comp. Financière Belge des Pétroles.

● *Contribution of Geochemistry to Study of Evolution of Crude Oils in Sedimentary Basins.* Symposium by group of French technologists.

Some crude oils exposed to air and sunlight evolve gradually toward the formation of asphalts. Particular hydrocarbons are transformed into resins; they subsequently yield asphaltenes and carbenes. This evolution is accompanied by a change in its chemical nature; thus a paraffinic or mixed oil produces a naphthenic asphalt. Similar transformations have been studied in several oil fields.

● *Status of Present Information on Origin and Accumulation of Oil*, by P. V. Smith, Jr., Standard Oil Development Co.

In past years, theorizing on the origin of petroleum has been influenced greatly by the fact that liquid hydrocarbons had never been detected in recent sediments. It has been widely proposed that petroleum was formed from the original "complex organic matter" through such agencies as bacteria, radioactivity, catalysis by the sediments, and possibly heat or pressure over indeterminate periods of time. In order to learn about the nature of the organic matter in recent sediments, a wide variety of fresh, brackish, and salt water deposits have been studied. In every case, paraffinic, naphthenic, and aromatic hydrocarbons have been detected.

● *Sand Facies of Recent Mississippi Delta Deposits*, by H. N. Fisk, Humble Oil and Refining Co.

Deltaic sand facies do not rest upon significant erosional unconformities as do deposits of transgressive seas, such as barrier island sands. They grade laterally and vertically into surrounding facies and pinch out basinward within a seaward-thickening wedge of silty clays. Similar sand bodies in older rocks form petroleum reservoirs, and facies relationships in the Mississippi delta complexes provide guides for interpreting the environmental conditions under which such sand deposits developed and for predicting their trends.

● *Interstitial Water of Oil Bearing Sands and Sandstones*, by W. von Engelhardt, Gewerkschaft Elwerath, Erdoelwerke-Hannover.

In natural sandstones pendular water at grain contacts and water films on the inner rock surface are distinguished. The dependence of these two kinds of irreducible water on the nature of displacing fluid is discussed. The possibility of transport phenomena in the water films as viscous flow, electrical conductivity and diffusion is investigated.

● *Progress of Regional Sedimentology*, by D. J. Doeglas, Agricultural University, Wagneningen.

Several new and partly unpublished studies on the regional sediments of the Rhine and Rhone rivers, the delta of the Rhone and Orinoco, the Gulf of Paria, the shelf around Trinidad, B.W.I. and environments in the Netherlands are briefly discussed. These studies include the regional distribution of mineral associations, size frequency types, microfaunas and other properties of importance for the determination of facies. The value of regional studies with detailed mapping and sampling and the use of uniform techniques is pointed out.

● *The Boundary Cretaceous-Eocene in Italy*, by M. B. Cita, Inst. di Geologia, Università di Milano.

The author studied from a micropaleontological point of view several stratigraphic sections from outcrops where a continuous sedimentation could be supposed. Environmental conditions being constant in Cretaceous and Eocene layers, the one cause which affects faunal changes is evolution as a function of time.

● *Significant Advances and Trends in Paleontology*, by Marcus A. Hanna, Gulf Oil Corporation.

Some advances and trends in neoecology are reviewed and in paleontology some applications are indicated. Increased use of statistical methods is cited. References to some new techniques are given. A part of the stimulus for advances and trends in paleontology and ecology is the expanding study of recent sediments and need for greater stratigraphic detail.

● *Ratio Between Pelagic and Benthonic Foraminifera as a Means of Estimating Depth of Deposition of Sedimentary Rocks*, by T. F. Grimsdale, F. P. C. M. van Morkhoven, Bataafsche Petroleum Mij.

Counts of pelagic and benthonic foraminiferal populations from the floor of the Gulf of Mexico have been plotted as percentages of total population in order of depth, both along the 12 individual traverses collected and in a combination chart. These histograms may provide an approximate method of estimating the absolute depth of deposition of foraminiferous sediments in Cretaceous and Tertiary open marine sequences; while it is considered probable that moving average curves similarly constructed from counts of fossil material will provide a means of determining the trends, from deep to shallow or shallow to deep water deposition.

● *Stratigraphic Correlation of Upper Cretaceous and Lower Cretaceous by the Aid of Microfossils*, by F. Bettenstaedt, C. A. Wicher, Preussag, Hannover.

In the course of intensive drilling for petroleum a reliable micropaleontological subdivision of the Cretaceous controlled by megafossils was established in northern Germany. Samples from other countries proved that many index fossils do also occur beyond Germany in almost all European countries, in Israel, Egypt, Morocco, U. S. A., Mexico and Trinidad.

● *Micropaleontologic Studies of the Upper Cretaceous in Mesogenic Seas.* A symposium by French technologists.

In each region examined where homogeneous sedimentation has continued without a break since the end of the Cretaceous until the beginning of the Tertiary, the authors have placed in evidence characteristic associations of pelagic foraminifera. The authors underline the parallelism of the faunizones with the equivalent formation of Trinidad. Their considerable geographic extension gives value to their stratigraphic importance.

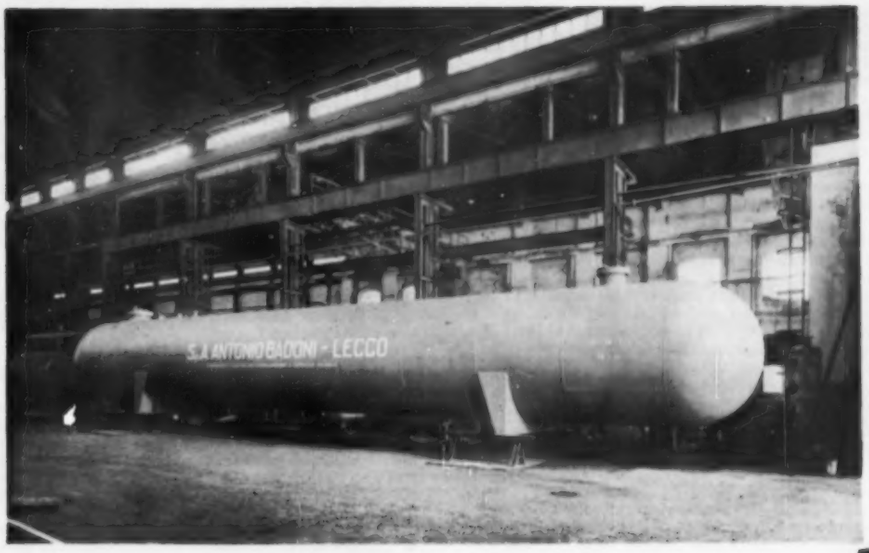
● *Electrical Methods of Oil Exploration*, by M. Migaux, Géza Kunetz, Compagnie Générale de Géophysique.

This paper aims at making more widely known the frequently ignored possibilities of applying electric methods to oil prospecting. After briefly recalling the peculiar characteristics which distinguish these methods from the traditional ones such as gravimetric and seismic, the paper furnishes a series of practical examples taken from prospecting carried out under varying conditions, and compared with the results of borings and other methods.

● *Geophysical Prospecting Over Continental Shelves*, by Henry C. Cortes, Ronald N. Gsell, Magnolia Petroleum Co.

Many difficult problems were encountered and solved in extending oil search offshore. The principal

(Continued on page 162)



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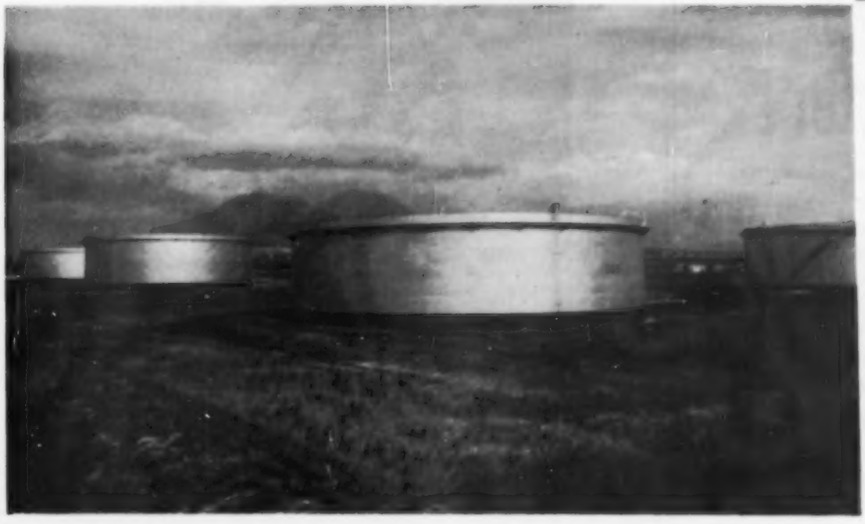

Tank, floating roof, 23,000 cm. Horton type.

Technical Program

(Continued from page 160)

methods used, in order of increasing resolution and operating costs, have been magnetic, gravimetric, and seismic. Major amounts of offshore geophysics have been done off California, Louisiana and Texas. Comparatively small areas have been covered offshore with the airborne magnetometer.

● *Oligo-Miocene Marine Formation in the Qum Region*, by M. A. Furrer, P. A. Soder, Kh. Takht-i-Jamshid - Teheran.

The search for oil in central Iran led to detailed stratigraphical and paleontological examinations of the Oligo-Miocene Marine Formation in the Qum region. Based on larger and smaller foraminifera, which abundantly occur, correlation of the particular units exposed at the surface as well as encountered in bore-holes is possible. In a brief discussion the Oligo-Miocene Marine Formation is compared with the Asmari Limestone in SW Iran.

● *New Aspects of the Geology in Central Iran*, by A. Gansser, Iran Oil Company.

A Central Basin began to form with the Upper Cretaceous and was well outlined during the Oligo-Miocene, and filled with shallow marine deposits. They form the only prospective oil formations and resemble somewhat the Asmari facies south of the Zagros range. The cap rock evaporites have produced about 50 saltdomes in Central Iran.

● *Cementation of Oil Reservoir Sands and its Origin*, by C. A. Fothergill, Royal School of Mines, London.

An investigation of the mineral cementation of oil reservoir sands from Venezuela has shown marked patterns of cement development in lenticular sands within a sand-shale series. Different cements have been introduced into the sands as a result of post-depositional sedimentary processes, and it can be shown that, in respect of the carbonate cements (calcite, dolomite, and ferro-dolomite) there is a marked increase in cement content vertically towards sand/shale contacts and there is evidence of a tendency towards an increase of cementation near the feather-edges of the lenses.

● *Location of Petroleum Accumulation by Facies Studies*, by L. L. Sloss, Northwestern University, Evanston, Ill.

Certain sedimentary aspects yield facies maps which may be directly interpreted in terms of possible oil accumulation while the mapping of other aspects leads to a greater understanding of a particular area, and, indirectly, to an estimate of petroleum potentialities. Facies studies in oil exploration may be considered at four levels, each succeeding level of analysis bringing to bear a greater concentration of data and an increased attention to detail.

● *New Developments in Seismic Methods*, by Henry Salvatori, Western Geophysical Co. of America.

Field equipment has seen several important improvements and new devices. Among these are the air and auger drills, specialized tracked vehicles and a cable handling device. Continuous control of velocities and moveouts of individual reflections removes an important source of interpretation errors. Research and development is proceeding apace from investigation of basic earth physics and information theory to new and improved instruments and techniques.

● *Exploration For Reefs by Geophysical Methods*, by F. J. Agnich, Geophysical Service Inc.

Methods used in geophysical exploration for limestone reefs are described. Where reefs are shallow and the density contrast with surrounding materials is relatively great, the gravity meter can be successfully employed. The seismic refraction method, like the gravity method, is strictly limited to shallow reefs. Even then a favorable contrast in velocity must exist between the reef and the geologic section around and above it. The most effective geophysical method in reef location has been the reflection seismograph.

● *Modern Methods of Gravity and Magnetic Interpretation*, by Sigmund Hammer, Gulf Research & Development Co.

Modern interpretation techniques in use under development are reviewed and illustrated by selected maps and figures. These include "residual" and "second derivative" maps, "resolution", "continuation", "statistics", and "electronic computations". Underground observations to yield a third dimension in exploration are included.

● *Geophysical Technique Employed For Petroleum Exploration in Mexico*, by Santos Figueroa, H., Petroleos Mexicanos.

By applying practically all available geophysical methods it has been possible to study a large part of the oil-bearing subsurface where conditions are extremely varied. In some cases special techniques have been employed in the investigation of reefs, high relief structures, salt domes, and fracture zones. As a result of the new exploration campaign there has been a steady advance in the accumulation of information.

● *Underwater Gravity Survey in the Adriatic Sea*, by C. Morelli, Istituto di Geodesia e Geofisica, Università di Bari.

● *Correlation of Geological and Geophysical Data*, by D. G. Skeels, Imperial Oil Ltd.

The importance is stressed of careful coordination of geological and geophysical data in both regional and local exploration. The application of geological information in guiding geophysical interpretations, and the use of seismic records in subsurface mapping of stratigraphic units is discussed and is illustrated by examples from several areas.

● *Comparative Geological and Geophysical Study* of the Po Basin, by T. Rocco, AGIP Mineraria.

After a reference to the development of the oil exploration which has been carried out during the last few years, general and critical information is given on the gravitational and seismic surveys made by AGIP Mineraria in the Po Valley. The results obtained with these two geophysical methods and with extended stratigraphic studies on a large number of wildcats are then compared in the light of the knowledge of the principal structural features of the Po Basin.

● *Development in Geophysical and Geological Exploration in Germany 1951-1954*, by Alfred Bentz, Hans Closs, Amt für Bodenforschung.

The type of geophysical and geological methods used in the three principal oil provinces of Ger-

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many depends on the type of geological structures. As yet the greatest success has been achieved in northwestern Germany where salt domes, anticlines, deepseated domes, fault-structures and stratigraphical traps abound. Oil exploration in Germany is characterized by very close cooperation between geophysics and geology in every phase.

● *Reflection-Seismic Exploration of Schleswig-Holstein*, by F. Hecht, DEA, H. v. Helms, PRAKLA, W. Kehrer, WIAG.

Detailed reflection-seismic surveys have been carried out all over Schleswig-Holstein. They have resulted in an accurate delineation of geological structures. The geophysical results have furnished detailed stratigraphical, lithological and structural data on the most dominant structures, the flanks of salt domes and sedimentary basins. As a result, the main structural units of Schleswig-Holstein have been disclosed.

SECTION II

(DRILLING AND PRODUCTION)

● *Unstable Behavior of Shale Formations in Boreholes and Its Control*, by J. H. M. A. Thomeer, N. V. De Bataafsche Petr. Mij.

Shaly formations often are a source of trouble in oil well drilling as a result of their leaning to deformation and caving. Serious complications which may arise from this shale unstability can best be avoided by the application of the proper drilling technique coupled to the use of a mud-flush having special and rigidly balanced properties.

● *Flow Characteristics of Oil Base Drilling Fluid (Trinidad)*, by H. D. N. Fitzpatrick, Trinidad Leaseholds Ltd.

The relationship between pressure drop and rate of flow for oil base drilling fluid flowing through 3-in. pipe line and 4½-in. and 5½-in. drillpipe has been studied experimentally. The viscosity of the same fluids was also studied and a new viscometer designed that is suitable for use in the field. Circulating pressures in a drilling well system have been calculated and agree reasonably well with the observed values; similar calculations may be used to find the size of drillpipe which gives the lowest pressure drop in a given hole.

● *Symposium on Drilling Muds*. Observations by French technologists on the behavior and handling of drilling muds.

● *Aspects of High Weight Muds Used in High Pressure Formation*, by P. W. Cooke, British Petroleum Co.

This paper discusses in some detail the two principal mud types for penetrating high pressure zones with particular reference to their physical composition. Reference is made to a particular well drilled in which a heavy mud was employed for over 8,000 feet. The problems of lost circulation and the hydraulics of circulating very heavy muds are analyzed. Some observations on the effect of mud weight on penetration rate are also included.

● *Modern Well Completion Methods in U. S. A.*, by A. L. Solliday, Stanolind Oil and Gas Co.

This paper presents a review of modern well completion methods in the U. S. A., with special emphasis placed on the most recent developments. These include (1) recognition and determination of the permeability impairment often incurred during drilling-in and perforating operations and partial elimination of this damage by the use of special drilling fluids; (2) development of methods and tools to eliminate need of a drilling rig during completion operations; (3) improved acidizing and chemical treating through the use of additives and surfactants; and (4) refinements and new applications of hydraulic fracturing.

● *Oilwell Gravel Packing Operations in Trinidad*, by A. S. Curlet, R. Pike, Trinidad Leaseholds Ltd.

Development is described of a gravel pack completion recommended as a standard completion method for new wells exploiting thick low productivity sands in areas where troublesome formation movement is to be expected. Results of remedial gravel pack operations carried out in existing troublesome wells are given to illustrate the benefits achieved.

● *New Drilling Developments*, by W. B. Brooks, L. W. Randerson, F. W. Shall, Magnolia Petroleum Co.

Since the first oil well was drilled, hundreds of drilling devices and techniques have been either field-tested or suggested as being worthy of consideration and experimentation. This paper is a review of several of the new drilling techniques and improvements in conventional methods. An indication of the potential applicability and limitations of each method is included in the discussion. Some of the methods discussed have already proved their economic worth.

● *Techniques of Drilling and Producing High Drift Angle Directional Wells*, by Daniel S. Johnston, Signal Oil and Gas Co., James T. Carried, Southwest Exploration Co.

During the past four years our companies have been developing leases between one and two miles offshore at Huntington Beach, California by directional drilling from onshore sites. Eighty-seven wells with drift angles over 60° have been drilled and completed. In order to conduct this operation on a routine basis it has been necessary to design new tools and adopt methods not previously considered in the art. In addition to directional control and well surveying techniques, problems in hole conditioning, drill pipe protection, electrical logging, running casing, cementing, well completion and production have had to be resolved.

● *Average Reservoir Pressure*, by D. R. Horner. No preprint available.

● *Symposium on Well Bore Surveys*, by J. E. Walström, Standard Oil of California.

When a hole has been drilled, or at intervals during the drilling, it is a general practice to run an electrical survey or a radioactivity survey to secure a complete record of the formations penetrated. Such recordings are of immediate value for the geological correlation of the strata, and also for the detection and evaluation of possibly productive horizons. In the present state of the electric logging technique, several different kinds of resistivity curves or logs can be recorded in bore holes in addition to the potential, or "SP", curve.

● *For a General Theory of Transients*, by A. Belluigi, Istituto di Geofisica Mineraria, Università di Cagliari.

The activation of electro-magnetic transients in an indefinite conductive medium has been the object of many theoretical and experimental researches

(Continued on page 166)

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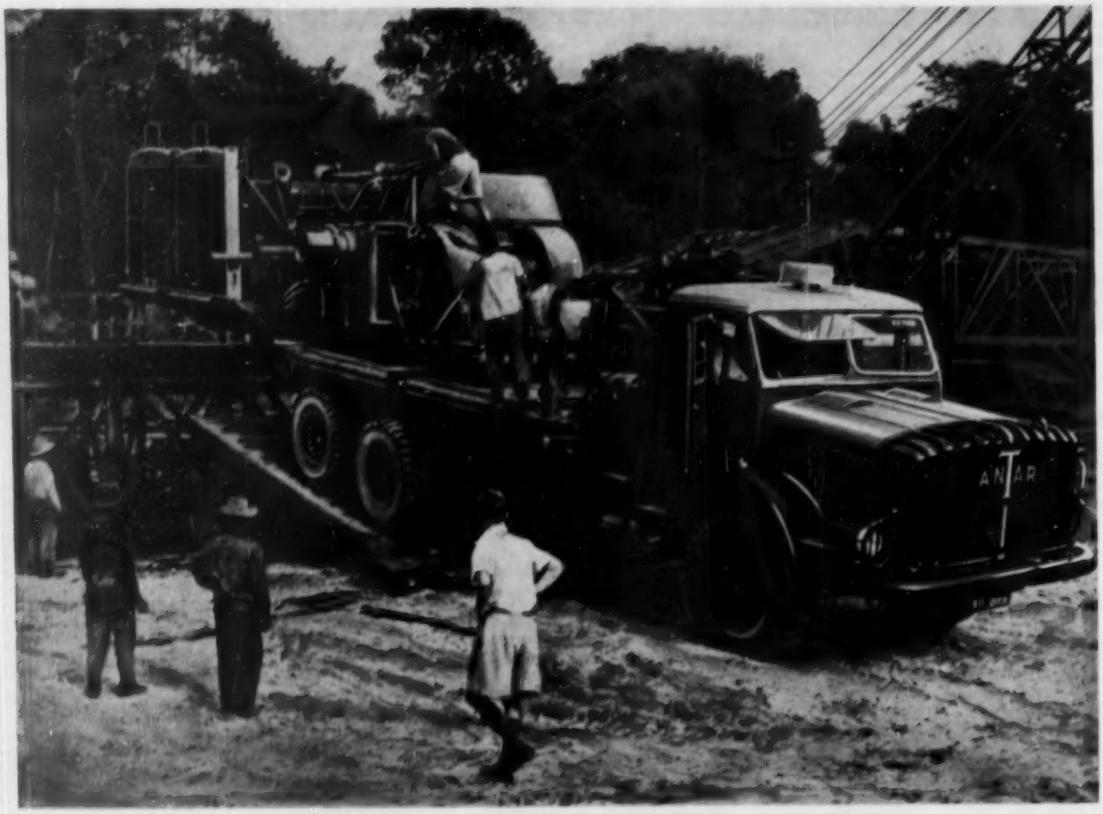

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FLYING A

Technical Program

(Continued from page 163)

in recent years. Owing to the different purposes of these researches most of the theories stated so far show only partial aspects of the e.m. geotrans. From the theory dealt with in this paper new important properties of geoeltrans may be deduced.

● *New Method of Fluid Sampling*, by J. Delacour, Soc. de Prospection Electrique, Procédés Schlumberger.

The purpose of this report is to illustrate a new method of taking fluid samples from formations traversed by drilling. The equipment consists of a series of suction core barrels operated by means of a lateral core of the conventional type. Each core barrel adheres to the boring wall at the level of the formation studied. The fluid from the interstices is then sucked inside the core barrel chamber where it remains until recovered above ground.

● *Recovery Increase By "Thermal Drive"*, by J. van Heiningen, N. Schwarz, N. V. d Bataafsche Petroleum Mij.

By comparing the increase in recovery obtained by a given, uniform rise in temperature of solution gas drive reservoirs with that obtained by the same rise in temperature of water drive reservoirs, it is shown that solution gas drive fields offer no prospects for heating methods; water drive fields on the other hand offer prospects, provided the oil/water viscosity ration is high enough. A survey is given of possible heating methods.

● *Study on P. V. T. Relations of Reservoir Fluids*, by W. R. von Wijk, D. A. de Vries, H. A. C. Thijssen, Agricultural University.

The fraction of gas flashed off a reservoir fluid when the pressure is decreased, is calculated. No equilibrium constants are used at high pressures. Fluid volume and gas volume are calculated with the aid of existing correlation methods, and if the bubble point pressure is known, the Y factor of the reservoir fluid can be calculated.

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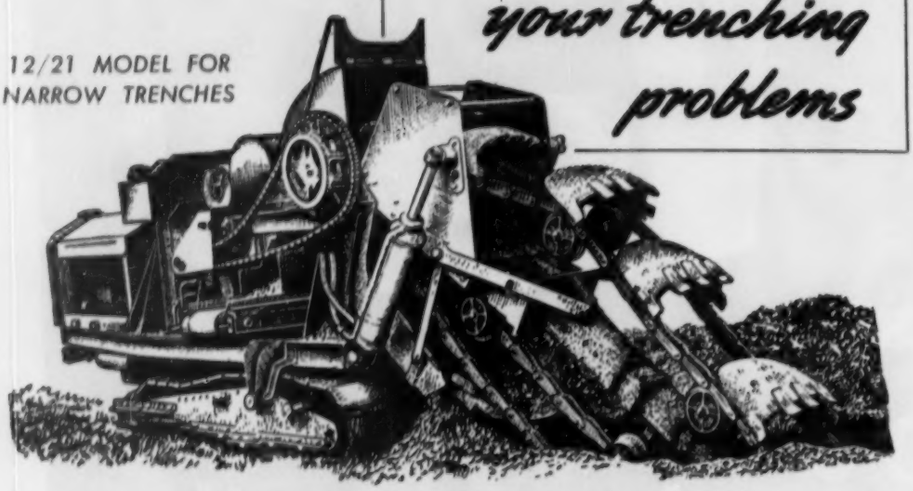

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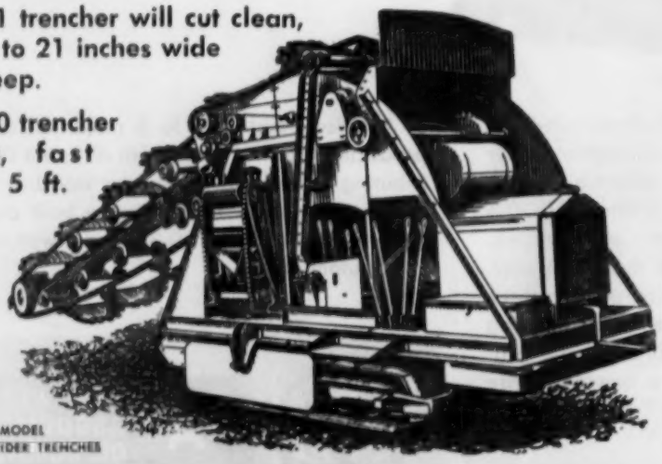

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● *Recent Application of Reservoir Treatment in Venezuela*, by John W. Butler, Phillips Petroleum Co., D. G. F. Bailey, Caracus Petroleum; J. W. Billiard, Texas Petroleum Co., Charles Dobbel, Pantepec Oil Co., B. N. Moore, Sinclair Oil & Refining Co., A. F. Pocock, Richmond Exploration Co., R. L. Slaton, Venezuelan Atlantic Refining Co., R. J. Tribbey, Socony-Vacuum Oil Co.

The chemical and physical treatments of oil-bearing formations in order to increase well productivity are discussed in the light of recent techniques and results in Venezuela. The subject covers types and combinations of formation fracturing, acidization, and injection of specific chemicals designed to modify the characteristics of the reservoir rock or the contents of its pores.

● *Pipe Line Flow of Oil and Gas Mixtures*, by P. B. Baxendell, Royal Dutch/Shell Group.

The purpose of this paper is to define a procedure simplifying use of the theoretical energy equation for predicting pressure losses in two-phase pipe line flow. An empirically derived relationship linking density, velocity and pipe size with friction factor is presented, which is analogous with the Reynolds Number relationship for single-phase flow. This relationship is believed to hold good under turbulent flow conditions regardless of crude characteristics.

● *Problems of Heavy Oil Production in California*, by J. J. McCullough, Union Oil Co. of California.

Typical drilling and completion programs are given. A review is made of production problems and the present equipment and techniques used in the solution of these problems. Treating, handling and transportation difficulties are outlined briefly, together with some of the economic problems of heavy oil and certain factors influencing the present selling price and possible future market in California.

● *Degasolination and Dehydration By Refrigeration of Natural Gas*, by J. Aymon, A. Narbonne, Régie Autonome des Pétroles.

Paper shows how these problems were solved by the "Régie Autonome des Pétroles" during the last World War; using a plant which was designed and set up specially for the purpose. The method adopted not only offered the advantage of being a pioneer process in modern technique, but at the same time enabled the delivery of large quantities of fuel which at that time was as scarce as it was precious.

● *Flow In Fissured Formations*, by W. J. Baker, British Petroleum Co. Ltd.

Experiments with an artificial fissure are described and the results applied to the estimation of the range of fissure sizes encountered in a limestone reservoir. The migration of oil and the productivity of wells in a fissured formation is considered and a comparison made between the behavior of fissured and unfissured reservoirs. Methods of increasing production from both types of reservoir are discussed with particular reference to acidization and formation fracturing. A method of detecting fissures is described.

● *Effect of Production Restriction on Iranian Oil Reservoir*, by W. J. Graham, The Texas Co.; G. Heatherington, Gulf Oil Co.; R. E. Old, Jr., Socony-Vacuum Oil Co.; V. Tuman, Iranian Oil Exploration and Producing Co.

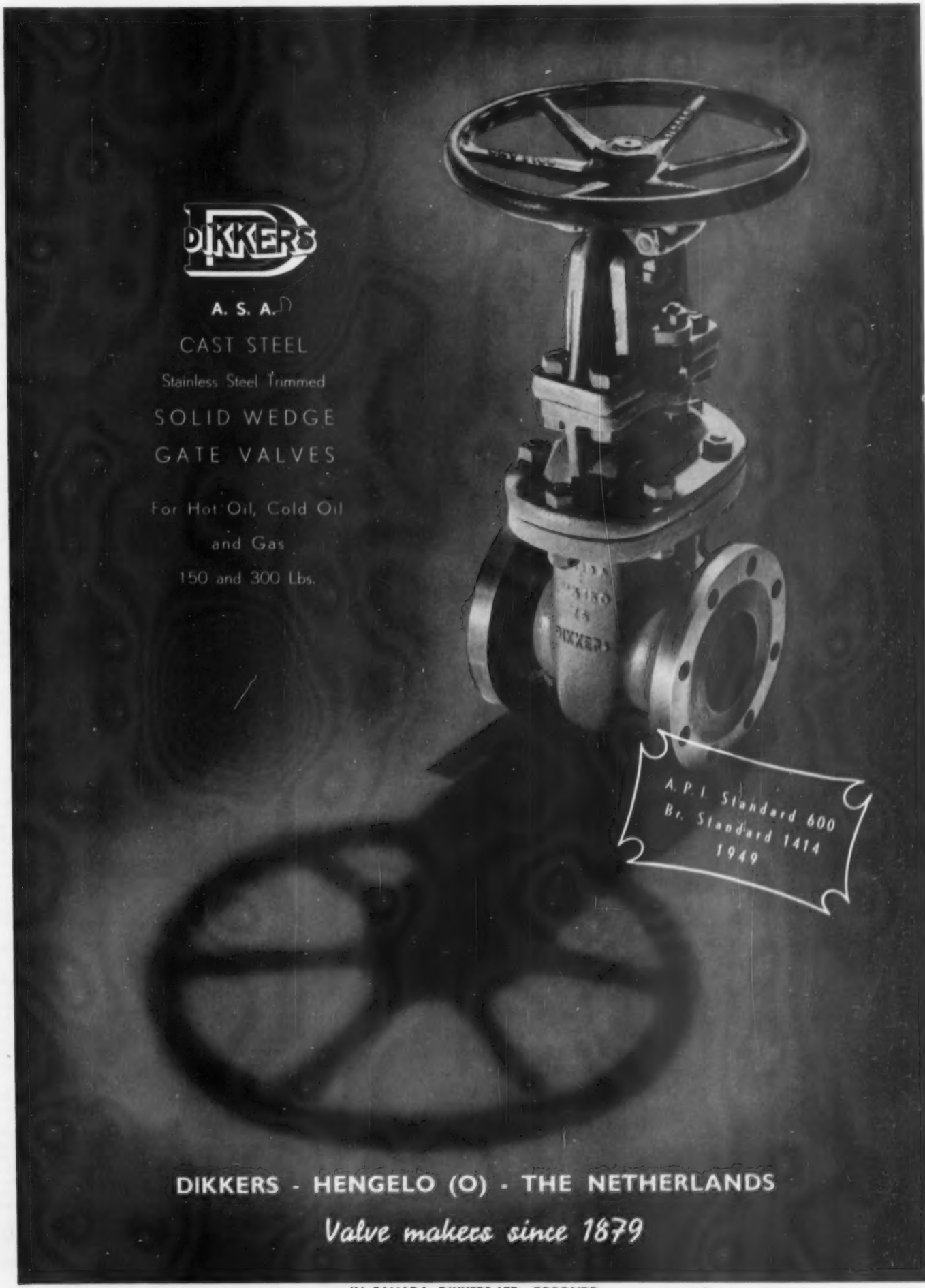
● *Correlation of Ultimate Oil Recovery With Reservoir Characteristics*, by Stuart E. Bulkley, Humble Oil & Refining Co.

The recovery of oil from a particular deposit is not a fixed quantity but depends on the method employed to recover the oil and on the skill with which the method is used. The application of technology to the recovery of oil requires, therefore, a comprehensive appraisal of each particular reservoir, the selection of a suitable recovery process, and control of the selected recovery process for the duration of production. This paper describes the manner in which a reservoir may be appraised and the proper recovery process selected.

● *A Theoretical Investigation Into the Recovery of Oil From Fissured Limestone Formations by Water-Drive and Gas-Cap Drive*, by J. Birks, British Petroleum Co. Ltd.

A fissured limestone formation is considered as blocks of oil-containing limestone of low permeability separated from each other by fissures which offer a negligible resistance to fluid flow. The dynamics of oil displacement from the blocks by water or gas-drive have been studied firstly by an idealised capillary model, and secondly by a simple relative permeability model. Typical examples are shown graphically of the effect on the rate of oil

(Continued on page 168)



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Technical Program

(Continued from page 166)

recovery of changes in fluid and rock characteristics. The merits of water-drive and gas-cap drive are discussed.

● *Influence of the Masses and Moments of Inertia of the Moving Parts of a Drilling Installation on its Hoisting Performance*, by H. M. Hohmann, Bataafsche Petroleum Mij., B. E. Buskin, Nederlandse Aardolie Mij.

In order to study the hoisting performance of an engine driven drilling installation, the masses and moments of inertia of the rotating and moving parts of the installation were first evaluated by application of a practical method which is fully described. With these data available, calculations were made of acceleration and hoisting times for different loads and the various drive speeds of the hoist for two methods of operation. Torque converters can compensate to a large extent for any lack of applied skill on the part of the driller in operating a hoist to best advantage.

● *Foundation Problems for Marine Drilling Platforms*, by A. Kranendonk, Bataafsche Petroleum Mij.

When drilling oil wells in submerged areas one of the major difficulties encountered is that of the foundation for the drilling equipment. In the course of developing a suitable and economical type of foundation many problems arise, necessitating studies in various fields of science. The object of the paper is to discuss the problems involved and to describe types of foundations designed and executed in various parts of the world.

● *Corrosion Effects of Hydrogen Sulfide and Carbon Dioxide in Oil Production*, by Walter F. Rogers, J. A. Rowe, Jr., Gulf Oil Corporation.

Laboratory studies have been made of the predominant factors in corrosion of steel by oil field brines containing hydrogen sulfide or carbon dioxide. A theory of corrosion under sulfide conditions has been developed which considers corrosion to occur in two stages. The first, or initial stage, is low and occurs until a sulfide cathode of low polarization characteristics develops; this results in the second, or high corrosion stage. Field data are presented supporting this theory.

● *Lightweight Steel Construction for Oil Drilling and Production Equipment*, by Georg Bierett, Erich Bahke, Salzgitter Maschinen A. G.

Manufacturers are finding ways to reduce the size and weight of components. In future exploration of impassable terrains such as jungle or mountains where the whole drilling equipment may have to be flown in, possibly by helicopters, the least saving of weight or volume may mean economic profit. The modern thinking man will have to get acquainted with lightweight construction ideas to cut down dead weight in machines and equipment.

● *Design of Combined Casing Columns*, by Juan Hefferan, F. Inguanzo, Gerencia de Explotaçion PEMEX.

Based on the biaxial stress relationship, a method is derived which permits design of combined casing columns without resorting to the usual cut-and-try method. A set of illustrative nomograms is presented to solve the case for 6⅝ inch casing. Additional tables are included for a quicker analytical solution for other diameters.

● *Volumetric Behavior and Conditions of Hydrate Formation of Natural Gas*, by R. Molinero, R. Fagegaltier, Inst. Français du Pétrole.

The authors present the study of the volumetric behavior and the conditions of hydrates formation of the natural gas from the "Lacq Profond" gas field, the composition of which shows 18 percent of hydrogen sulfide and 8 percent of carbon dioxide. Experimental work has been executed under pressions covering the range from 0 to 700 kg/cm² and temperatures to 150°C. To secure both personnel safety and sound results, the construction of a P.V.T. equipment, perfectly corrosion resistant, has been achieved.

● *The Terminology of Petroleum Reserves*, by Frederic H. Lahee, Sun Oil Co.

In order to avoid confusion in the presentation of data on reserves of petroleum and natural hydrocarbon gas, the recommendation is made that a standardized terminology be adopted and particularly that authors, speakers, and estimators within this field of study clearly explain the exact significance of their figures. A method of classifying reserves is outlined in detail.

SECTION III

(OIL PROCESSING)

● *White Oil Manufacture*, by V. Biske, A. Cluer, Lobitos Oilfields, Ltd.

Highly refined colourless lubricating oils, employed for specialized lubrication, food processing, and pharmaceutical purposes, are consumed in the United Kingdom to the extent of about 15,000 tons/yr. Such oils are manufactured by oleum refining of selected raffinates. Alternative methods of white oil production are briefly mentioned. Testing on white oils is considered, especially with reference to carbonizable substances and stability to sunlight; indications are that latter may be predictable by results of exposure of oil to a carbon arc.

● *Reconstruction of Bari and Leghorn Refineries*, by U. Galati, STANIC-Industria Petrolifera.

The Leghorn refinery was dismantled during the German occupation. The Bari refinery, while having suffered little damage during the war, was faced with problems arising out of a production flowchart wholly different from that for which it had originally been built. The author describes the events which led to the construction of the two refineries, and goes on to speak at some length of the various phases in reconstruction and modernizing carried out.

● *Cristallization by Urea in the Operations of Refining*, by A. Champagnat, J. Laugier, Y. Rollin, C. Vernet, Soc. Français des Pétroles BP.

In a semi-industrial unit, this problem has been solved by using a special solvent and carrying out the separation by decantation and washing. The use of the process in combination with a topping plant simplifies the redistillation step of the washing solvent. It has also made possible the study of further applications of the extractive crystallization.

● *Recent Developments in Fractional Distillation*, by A. P. Colburn, J. A. Gerster, University of Delaware, Cyrus Pyle, E. I. du Pont de Nemours and Co.

The important design and operating variables

(Continued on page 170)

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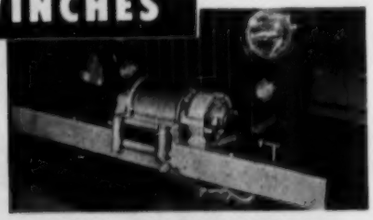

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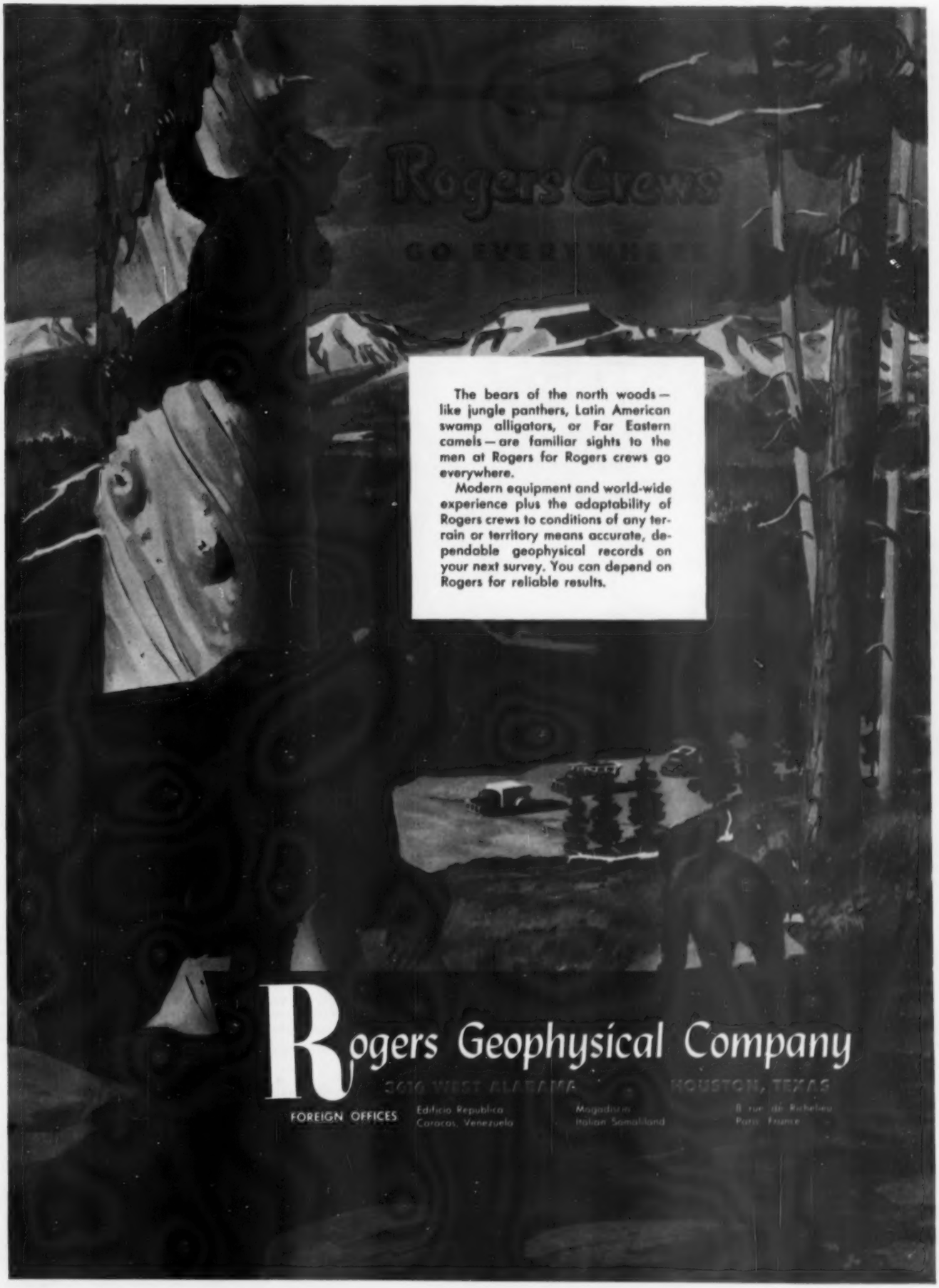

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Technical Program

(Continued from page 168)

affect column operation differently depending upon the controlling transfer rate. Quantitative relationships are shown for prediction of plate efficiencies as a function of the physical properties of the system, the gas and liquid rates, the liquid depth, and the tray layout. Of the many recent developments in design of vapor-liquid contactors, one of the most widely used is the sieve plate.

● *Fundamentals of Mixing in Petroleum Refining*, by J. Henry Rushton, Illinois Institute of Technology.

The mechanics of flowing fluid streams are described to show how mass flow and turbulence are generated and used to produce the effects required for the different processes. The characteristics of equipment used for mixing are discussed in terms of the type of fluid motion they produce, and some performance data are given.

● *Study of Heat Transfer by Radiation*, by Maurice Delpech, Esso Standard S.A., Georges Monnot, Inst. Français du Pétrole.

Experiments have been carried out in two different refinery heaters in order to evaluate heat transfer distribution in the so-called radiation area of the earth. In addition to conventional measurements of the crude temperature and pressure in different points of the coil, a total radiation pyrometer and a new type of wall calorimeter have been employed. In these conditions, it has been possible for the authors to evidence the role of a number of variables influencing hearth control. Obtained data may be of help in improving thermal efficiency or, in some cases, refining capacity.

● *Influence of Pressure on Filtering Rate in Dewaxing*, by A. F. Orlicek, Technical University, Vienna.

The mathematical aspect of the theory of filtration is developed in view of the fact that in wax filtration the cake consists of extremely soft, easily deformed particles. The influence of consolidation of compressible filter cake has been investigated with the result that, for mathematical reasons, a maximum filter rate at an optimum pressure may be due only to processes taking place in the boundary layer of the filter but not in the filter cake itself.

● *A Pilot Plant Employing a Novel Process for Urea Extraction of Hydrocarbons*, by L. N. Goldsbrough, Shell Petroleum Co., Ltd.

The conventional separation, by filtration, of adducts of urea and straight chain hydrocarbons presents some practical problems if a feedstock of high straight chain content is being processed. The paper describes an alternative approach to the purification of straight chain hydrocarbons by urea extraction through which, by incorporation of surface active agents and inorganic salts in aqueous urea solution, filtration can be avoided. The two types of approach are compared and it is concluded that they should be regarded as complementary rather than competitive.

● *Urea Reaction for Dewaxing of Washed Blue Oil*, by K. V. Gopalan, Assam Oil Co., Ltd.

Comparative dewaxing of WBO with urea solution on the one hand and with MEK on the other, were completed. The dewaxed blue oils were distilled into fractions, and the effect of dewaxing on the cold test, viscosity and viscosity index of the fractions was studied for each series. That urea dewaxes more in the fore-end of WBO whereas MEK acts in a contrary manner is shown by the results.

● *Continuous Percolation of Lubricating Oils*, by A. O. Pukkila, H. W. Shea, Socony Vacuum Oil Co., J. W. Bartholomew, Vacuum Oil Co. Ltd., R. B. Killingsworth, Vacuum Oil Co.

The first commercial unit for percolation of lubricating oils by the "Thermofor Continuous Percolation" process has been put into operation at the Coryton refinery of Vacuum Oil Company Ltd. A description of the process and equipment, together with representative commercial operating data on yields and decolorizing efficiency, is given for a range of typical lubricating oil base stocks.

● *New Process of Refining*, by A. Gislon, J. M. Quiquerez, Compagnie Française de Raffinage.

The paper describes a new process for refining petroleum products which consists in oxidizing the mercaptans in the presence of kelate compounds. The kelate is dissolved in cresol or methanol and the process is carried out preferably in a neutral medium. All petroleum products can be treated by this process, whatever their origin or molecular weight.

● *The Autofining Process; The Production of Low Sulfur Diesel Oils*, by J. W. Hyde, F. W. B. Porter, Sunbury Research Station.

Considerable advances have been made in the application of the Autofining Process, a catalytic desulfurization process developed by the Anglo-Iranian Oil Co. Ltd. These advances have been made possible by the development of an improved catalyst and by changes in operating technique which enable Diesel fuels to be produced with less than 0.1 percent weight sulfur content from high sulfur feedstocks.

● *Theoretical and Technological Research on Desulfurization of Light Petroleum Distillates*, by C. Padovani, V. Berti, A. Girelli, A. M. Ilardi, Stazione Sperimentale Combustibili Politecnico di Milano.

The elimination of sulfur compounds from petroleum light distillates, by low pressure thermocatalytic decomposition on alumina-base catalysts has been experimentally investigated. The advantages of catalytic desulfurization over the various liquid-phase processes are dealt with. Finally a number of practical data are given, concerning desulfurization carried out in the laboratory or on a commercial scale, employing natural and synthetic alumina-base catalysts.

● *Fluid Hydroforming*, by C. W. Tyson, Esso Laboratories.

No preprint available.

● *Platforming, Present and Future*, by Vladimir Haensel, J. W. Walter, Universal Oil Products Co.

During the last four years UOP Platforming has become a major catalytic process in the petroleum industry, being second only to catalytic cracking in capacity. The early operations were designed solely for the upgrading of straight run stocks into high octane gasolines. Later developments led to the utilization of Platforming for the production of specific aromatic hydrocarbons and aviation gasoline blending components. The present paper deals in part with the effect of feed stock composition upon the reactions taking place in Platforming.

(Continued on page 172)

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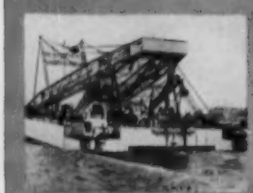

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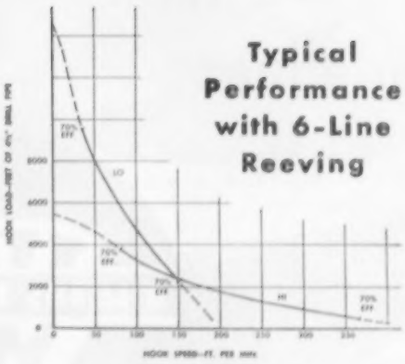

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Technical Program

(Continued from page 170)

● *Chemical Conversion by Isomerization and Dehydrogenation Catforming*, by M. J. Fowle, R. D. Bent, B. E. Milner, Atlantic Refining Co.

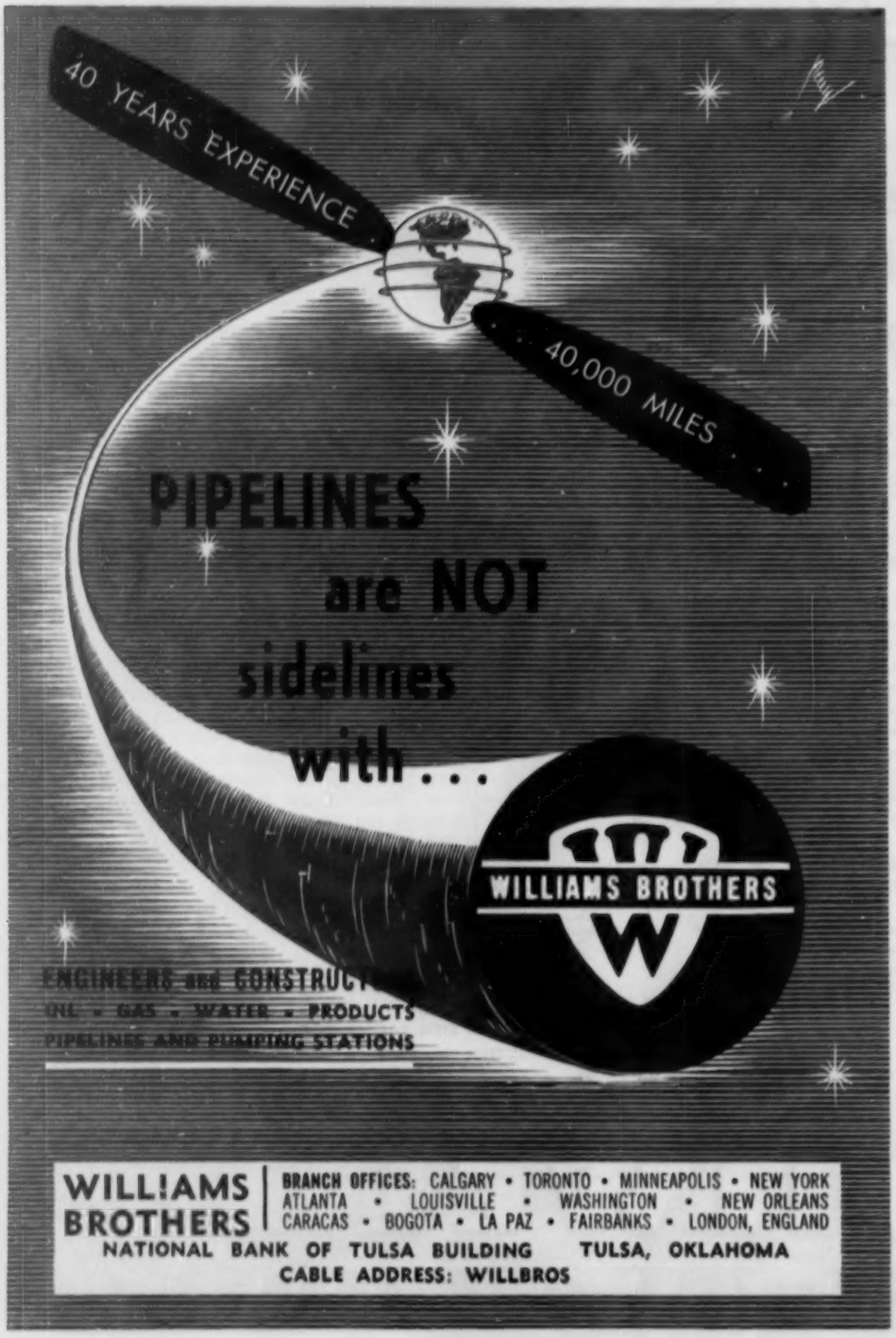
The role of isomerization as a specific catalyst function in the field of paraffin, naphthene, and aromatic chemical production is reviewed. The relative importance of isomerization, dehydrogenation, and dehydrocyclization for octane improvement is also presented, together with the behavior of the products of these reactions in automotive engines.

● *Regenerative Platinum-Catalyst Reforming of Naphthas*, by J. K. Roberts, E. W. Thiele, R. V. Shankland, Standard Oil Co., Indiana.

Ultroforming is a new fixed-bed catalytic reforming process developed by Standard Oil Company (Indiana). The distinctive features of this process are the use of a platinum catalyst at relatively low pressure, and a special regeneration technique. Low operating pressure is used because it gives better yields of gasoline and by-product hydrogen, permits a higher ceiling octane number without excessive loss of yield, and results in higher effective catalyst activity.

● *Relative Effect of Deactivating Agencies on the Performance of Silica-Alumina Cracking Catalyst*, by N. J. H. Small, P. H. S. Kirkaldy, A. Newton, Trinidad Leaseholds Ltd.

Fresh synthetic catalyst added daily to the inventory of a commercial T. C. C. unit suffers a rapid loss of activity. In an attempt to assess the relative contribution to this loss from the major known deactivating agencies, the separate effects of heat, steam, trace metals and carbon were studied in relation to catalyst activity, selectivity and surface properties. The extent of thermal deactivation is dependent on both time and temperature, and is always accompanied by pronounced changes in the surface properties of the catalyst and by a small loss of water.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● *The Houdriflow Catalytic Cracking Process Today*, by H. D. Noll, J. C. Dart, R. E. Bland, Houdry Process Corporation.

This paper describes the present status of the Houdriflow moving bed catalytic cracking process. Emphasis is placed on recent mechanical improvements made and commercial experience achieved during the past few years. Typical results are given for two commercial Houdriflow installations illustrating the flexibility of the process in handling highly different charge stocks.

● *Advances in Fluid Catalytic Cracking*, by E. J. Gohr, Standard Oil Development Co.

This paper summarizes the postwar growth of the fluid cracking process, and discusses the main design and process advances made in that period. A combination of design, mechanical, and process improvements substantially lowered fluid plant investments and operating costs. The new designs are considerably simpler and more compact, reflecting simplified catalyst recovery, more compact catalyst circulation systems, smaller vessel sizes, and generally improved mechanical features and plant layout.

● *Recent Developments in TCC Cracking*, by E. V. Bergstrom, V. O. Bowles, L. P. Evans, J. W. Payne, Socony Vacuum Laboratories.

This paper discusses the improvements made in the Thermofor Catalytic Cracking (TCC) process since 1951. These developments make possible substantial increases in reactor and kiln capacities while still maintaining high cracking efficiency. The authors discuss the improved mixed-phase feed technique currently being used in several commercial units. The causes and effects of heavy metals poisoning are discussed; showing how metals are selectively removed from the system with the catalyst fines. Data are presented for processing a wide range of charge stocks to produce a variety of products.

● *The Influence of Catalytic Cracking and Other Catalytic Processes on the Production of Italian Refineries*, by G. De Sanctis, A. Messenio, F. G. Piscia, CONDOR S. p. A.

The paper summarizes the present situation of total motor gasoline yield, average octane level, and process facilities according to the requirements of Italian markets. A typical case is considered in detail, showing how Middle East crude is fractionated in various straight run basic cuts by atmospheric and vacuum distillation, then is converted into finished products by upgrading some select cuts to high octane gasoline by catalytic cracking and reforming processes.

● *Improvement of Activity and Selectivity of Solid Catalysts*, by Ernst W. Nagelstein, Paris & Marxzell.

It is shown in this work, by the examples of alumina and alumina-containing catalysts, that many commercial catalysts — despite their apparent homogeneity — are in fact mixtures of differently active and selective components. These contact-times have been modified within large limits and thus catalysts of defined and predicted activity and selectivity have been obtained. The suitability of aluminas in composed catalysts, especially in cracking catalysts, has been examined. A way for improving the preparation of cracking catalysts, as well as synthetic and natural catalysts, is indicated.

● *Practical Application of Combination Processing*, by J. A. Beukers, H. P. Kelder, Esso Standard Refinery.

No preprint available.

● *Fluid Coking of Residua*, by A. Voorhies, Jr., Esso Standard Oil Co.

A new coking process called "Fluid Coking", is the latest application of the fluidized-solids technique. The Standard Oil Development Company is the originator and licensor of this new process which was developed to meet the acute need for a simple, rugged, continuous coking process. The Fluid Coking process employs no catalyst; it depends upon the heat and surface area provided by a circulating stream of finely divided coke particles.

● *The Hoechst Continuous Coking Process (Germany)*, by Hans Krekeler, Ffm. Hoechst.

Various reasons are adduced for the different ways in which the production of chemicals from petroleum have developed in the U. S. A. and in Germany. The characteristics of the most important processes already known for the production of olefines are outlined. The lines of thought which led to the development of the Hoechst continuous coking process are described.

(Continued on page 174)

Inside of Reactor

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DISTILLATION COLUMNS

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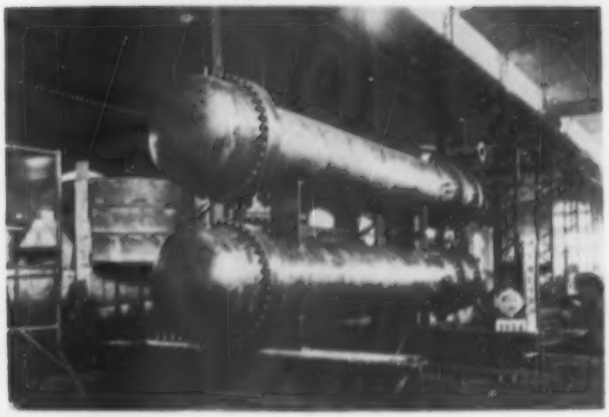

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TERNI - ITALIA

Technical Program

(Continued from page 172)

● *Some Aspects of Gasoline Treating Processes*, by J. W. le Nobel, Koninklijke/Shell Laboratories.

First of a survey is given of some reasons why gasolines have to be refined and of the components which are responsible for undesirable properties. The importance is stressed of a detailed analytical study to determine which components should be removed and to enable a choice to be made for each particular case of the most efficient and economical treating process.

● *Fundamentals of Bitumen Blowing*, by M. J. Goppel, J. Knotnerus, Koninklijke/Shell Laboratorium.

Since relatively little is known about the chemistry of the blowing process, an investigation was initiated to clarify the reactions involved and to establish to what extent each contributes to the overall modification of the properties of the material. It was found that all the oxygen taken up by the bitumen can be accounted for by the formation of hydroxyl, carbonyl, acid and ester groups; no ether oxygen could be detected. This mechanism results in an increase of alphaltene content and in a change of the colloid-chemical constitution and the rheological properties of the bitumen.

● *The Mechanism of the Dehydrogenation Reaction of Hydrocarbons and the Role of Hydrogen in Aromatization*, by K. Peters.

No preprint available.

● *Technological Developments in Retorting Colorado Oil Shale*, by Boyd Guthrie, Oil-Shale Engineering Branch, Bureau of Mines.

The tremendous reserve of oil contained in the oil-shale deposits of Colorado prompted the Congress of the United States to initiate a research program to determine the feasibility and methods of mining and retorting oil shale and converting shale oil into usable products. This work has been in progress for 10 years by the Bureau of Mines at the Oil-Shale Mine and Engineering Experiment Station near Rifle, Colorado and the Petroleum and Oil-Shale Experiment Station, Laramie, Wyoming. At Rifle, a number of pilot-plant retorts were built and tested, including the NTU, Royster, gas-flow, dual-flow, countercurrent, and gas-combustion processes.

● *The Shale Oil Industry in Sweden*, by Claes Gejrot, Edmund Schjànberg, Swedish Shale Oil Co. Inc.

The Swedish shale oil plant at Kvarntorp, which was built during the war, has since been largely reconstructed, extended and modernized. It is now in a position to cover its costs in full, including normal depreciations, and to render a return on the invested capital. Manufacturing costs must however be further reduced and its products more widely utilized and refined.

● *Refining of Bituminous Schists by Hydrogenation*, by Ramon Sànchez Delgado, Juan Rodriguez Jurado Empresa Nacional Calvo Sotelo.

A bituminous shale-oil of Puertollano (Spain) has been hydrogenated at low temperature in a pilot plant. The process was carried out at six different temperatures. The yield of the different products obtained by hydrogenated samples fractionated and refined in the laboratory has been established. This paper, however, deals only with lubricating oils.

● *Pilot Plant Experiments on Combustion of Israel Oil Shale*, by O. Schächter.

No preprint available.

● *Chemical Products in Refinery Effluents*, by D. Giraud-Desjuzeur, A. Van Langermeersch, Esso Standard, Française.

The method described achieves the continuous individuation of the presence of certain compounds in process plant effluents by a colorimetric technique. A simplified recording colorimeter has been developed. The instrument includes an electron photomultiplying cell whose current output is sufficient to operate a recorder without requiring any intermediate amplification. This method has been used for the determination of phenol.

● *Atmospheric Pollution Problems Associated With Refining*, by A. W. W. Kirby, Shell Refining and Marketing Co. Ltd.

An account is given of problems which were foreseen at the design stage of a major refinery in the United Kingdom, together with the methods that were adopted at that time to solve them.

● *Air Pollution Problems and Control*, by I. McCallum, P. G. Layzell, R. A. Vere, Esso Petroleum Co. Ltd.

Effective control over atmospheric pollution has presented specific problems and many of the measures taken to minimize air pollution were included in the basic design of the refinery units. Among these were: (a) The preferential use of gas for furnaces, and the provision of cyclones to remove solid particles from effluent gases. (b) Design and operation of furnaces and stacks to prevent smoke. (c) Exclusion of sulphuric acid to minimize sulphurous fumes. (d) Measures to prevent crude or partially refined products from releasing fumes to the atmosphere. (e) Provision of a deodoriser for the treatment of spent caustic soda streams. (f) Provision of a Sulphur Recovery Plant to reduce the quantity of sulphur compounds being expelled.

● *Report on Deodorization of Refinery Effluents*, by I. McCallum, J. A. Shaw, C. H. S. Gill, H. Peters, Esso Petroleum Co. Ltd.

The system employed at Fawley for reducing air pollution from liquid wastes consists of a combined neutralization and stripping of the spent caustic and H_2S bearing streams. The operation is carried out using hot boiler flue gas and steam. This report describes the design and operation of the spent caustic deodorizer and discusses corrosion problems and other difficulties which have arisen since the startup of the unit.

● *Petroleum Refining With Hydrogen*, by W. E. Bradley, G. W. Hendricks, H. C. Huffman, Union Oil Co. of California.

Although the potentialities of hydrogenation as applied to oil refining have long been recognized, it has had little commerical use by the petroleum industry because of the high cost of facilities and hydrogen for the processing. Now, with the availability of increasing amounts of hydrogen as a by-

(Continued on page 176)

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For low cost treating under average conditions, BS&B Type "S" Vertical Treaters like this one perform excellently. It has a capacity range of from 100 to 2500 bbls./day, depending on the size of the treater. The Type "SCW" is structurally the same as the Type "S", except for modifications to adapt it to cold weather operation.

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Technical Program

(Continued from page 174)

product from catalytic reforming and the appearance of processes which can economically upgrade a wide variety of stocks under relatively mild conditions, hydrogenation as a refining process appears to be on its way toward becoming an important tool for the petroleum refiner.

● *Hydrogenation of Crude Oils in Germany*, by M. Pier, Ammonia Lab. Badische Anilin & Soda - Fabrik AG.

The four hydrogenation plants in Western Germany have a crude oil topping capacity of over three millions tons/year, and an oil residues hydrogenating capacity of one million tons/year. In 1953, they produced about one half of the gasoline, and one third of the Diesel oil consumed in Western Germany. Middle East and German crude oils, which are rich in hydrogen and sulfur, were used as raw materials. Since the fuel oil consumption in Germany is comparatively low, these crude oils must be entirely converted into fuel. The fuel demand in Germany is for equal quantities of gasoline and Diesel oil.

SECTION IV

(PRODUCTION OF CHEMICALS FROM PETROLEUM)

● *New and Advanced Developments in Tetramer, Cumene and Motor Polymer*, by Gustav Egloff, E. K. Jones, Universal Oil Products Co.

Catalytic polymerization using UOP solid phosphoric acid catalyst was first developed for the petroleum refining industry for the production of high octane motor gasoline from waste refinery cracked gases. However, it is now rapidly expanding in the petrochemical field and includes the production of such chemicals as tetramer, cumene, butyl benzene and ethyl benzene. The economics of producing these petrochemicals are even more attractive than producing motor fuel polymer. Simplified units have been constructed which will make cumene, tetramer, butyl benzene or motor polymer in the same unit in blocked-out operation. However, process details in this article will be limited to tetramer, cumene and motor polymer. The equipment required for producing these three products is essentially a charge pump, heat exchangers, catalyst chamber, depropanizer, debutanizer and rerun columns.

● *Routes to Ethylene Manufacture*, by J. W. Woolcock, Imperial Chemical Industries Ltd., Billingham.

There is no one best way of manufacturing ethylene in all circumstances. The optimum route depends on the scale of production required, on the raw materials readily available in a given geographical location and the use which can be made of co-products which arise in some methods of manufacture. Except in the uniquely favorable circumstances of Texas, where ethane containing natural gas and refinery gases are amply available, the choice is generally between the utilization of refinery gas and the deliberate cracking of oils in special apparatus to give a maximum yield of ethylene and other olefins. Increasing attention is being given to the use of non-distillate oils, such as crude and reduced crude, for this purpose.

● *Catalytic Gasification of Heavy Oils to Produce Ethylene and Propylene*, by Marcel Patry, director, Emmanuel Luzarreta and Claude Paul, engineers, National Industrial de L'Azote à Toulouse.

Two methods are set forth: The first consists in a preliminary treatment of the heavy oil by steam in a flashing distillation aparatus, to separate the volatile hydrocarbons from the heavier components. The volatile hydrocarbons are processed by thermal cracking in the presence of steam in tubes heated from the outside by flue gases proceeding from combustion of the heavy components.

The second method is a cyclic one. During the conversion stage, fuel is injected in the presence of steam over a particular nickel-base catalyst. During the heating stage, the carbon deposited on the catalyst during the conversion stage supplies a considerable part of the heat necessary for running the process. As with the previous method, combustible gases and liquids are recovered.

● *Reactions of Olefins*, by G. E. Limido, Inst. Français du Pétrole.

This paper deals with a certain number of conversions generating or utilizing olefins. First it presents kinetic study of the dehydrochlorination reaction of chlorinated derivatives, and of its reverse, hydrochlorination of olefins. The former is an interesting way of producing olefins unobtainable by currently used methods, while the latter, starting from any olefin whatsoever, produces the corresponding chlorinated derivative, which is an important intermediate for further syntheses.

● *Recovery and Oxidation of Isomeric Xylenes*, by W. G. Toland, E. L. Nimer, California Research Corporation, Richmond.

Processes used for separating and recovering high purity orthoxylene, metaxylene, and paraxylene from typical mixtures of xylenes manufactured from petroleum are briefly reviewed. Processes for the recovery of orthoxylene by fractional distillation and paraxylene by fractional crystallization have reached a high degree of development and are used for large-scale industrial production of these isomers. Methods for the oxidation of xylene isomers, particularly to the aromatic, dibasic carboxylic acids and their derivates, such as phthalic anhydride and dimethyl iso- and terephthalates, are reviewed and discussed.

● *Chemicals by Direct Oxidation of Hydrocarbons*, by E. T. Powers, Celanese Corporation of America, New York.

The oxidation of hydrocarbons is based upon the four principal raw materials commercially used: methane, ethane, propane, and butane. A description is given of the more significant of these processes now in operation. The effect of reaction variables (temperature, pressure, reaction time, catalyst, and reactant ratio) upon product yield and distribution is illustrated. The influences of reaction techniques (vapor phase, oxidation, catalytic vapor phase oxidation, and liquid phase oxidation) are explained. The effect of reaction techniques on two Celanese processes is discussed. Conclusions for future trends are drawn.

● *Acetylene by Partial Oxidation of Methane*, by E. Bartholomé, Ammoniaklaboratorium der Badis-

(Continued on page 180)

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Trends and Forecasts
Inter-regional Movements
Foreign Trade
Prices
Investments, Expenditures
Oil Finding and Development Costs
Reserves
Exploration, Drilling
Production
Natural Gas
Refining and Processing
Petro-Chemicals
Natural Gasoline
Gas Cycling, Carbon Black
Marketing and Utilization
Transportation
Communications

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International Oil Movements
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Trends and Forecasts
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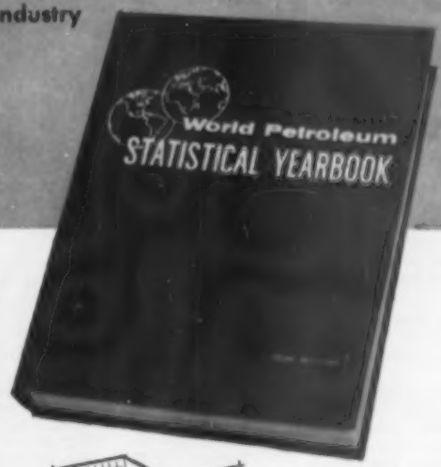

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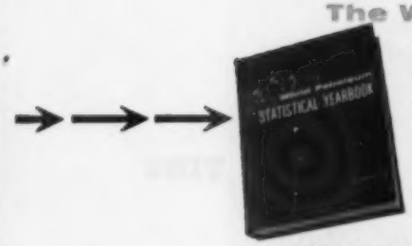

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Technical Program

(Continued from page 176)

chen Anilin & Soda Fabrik AG., Ludwigshafen am Rhein.

Methane is available in ever increasing amounts as the main component of natural gas. By incomplete combustion with oxygen it can be converted into acetylene. A part of the methane is converted into carbon monoxide, carbon dioxide, hydrogen and water. The heat developed by this process is sufficient to increase the temperature of the mixture to about 1400°C and to furnish heat for transformation of the remaining methane into acetylene and hydrogen. From the resulting gas mixture it is possible to recover acetylene sufficiently pure for chemical synthesis.

● *Synthesis of Hydrocarbons by Oxidation*, by J. C. Balaceanu, Inst. Français du Pétrole.

The most rational process is direct oxidation by air or oxygen utilizing the cheapest oxidizing reactant; in practice, controlled combustion. However, it demands extremely accurate control on the kinetics of the reaction, otherwise a series of products will be forthcoming which may or may not be of interest and are costly to separate. By oxidation in liquid phase the reaction can be efficiently controlled. Even with liquid oxidation processes, however, it is impossible to avoid the production of detonating gases in the fractionating equipment.

● *Studies and Experiments in the Partial Oxidation of Methane*, by C. Padovani, G. Salvi, A. Fiumara, Stazione Sperimentale Combustibili - Politecnico di Milano.

Some kinetic aspects of partial oxidation of methane by oxygen and air on nickel catalysts were studied. Experiments on the thermic effects and CO_2 formation related to the space-velocity confirmed the hypothesis of a two stage mechanism according to which products of complete CH_4 oxidation are first formed and subsequently react with the residual methane to CO and H_2. Other experiments showed that the rate of reaction of methane with free oxygen is much higher than that of the reaction with CO_2 or H_2O.

● *Partial Oxidation of Methane by Pure Oxygen*, by G. Salvi and A. Fiumara, Stazione Sperimentale Combustibili - Politecnico di Milano.

The authors have carried out thermodynamic research on the reaction occurring in partial conversion of methane with pure oxygen or with air, and determined the reaction gas composition at equilibrium, for temperatures ranging from 800 to 1400°K, at atmospheric pressure, and for O_2/CH_4 ratios of from 0.555 to 0.715. The minimum O_2/CH_4 ratios by different temperatures were also determined above which no elemental carbon is formed.

● *Oxo-Synthesis; Methods of Treatment*, by Ibrahim Daki, Istituto di Ricerche G. Donegani.

No preprint available.

● *Surface Active Agents From Petroleum*, by J. C. Sanford, Chemical Materials Pty, Ltd.

This paper reviews the more important surface active agents manufactured by incorporating petroleum fractions or their derivatives in the molecular structure. Methods of production and chemical properties are outlined, and illustrations given of the more important economic parts played by the surfactants as related to the ultimate field use of the end products in which the surfactants are incorporated. Special attention is paid to those aspects bearing on Australia's national economy.

● *Chemicals From Acrolein*, by S. A. Ballard, H. de V. Finch, B. P. Geyer, G. W. Hearne, C. W. Smith, R. R. Whetstone, Shell Development Co., Emeryville, California.

By virtue of its conjugate structure, acrolein participates in reactions of the Diels-Alder type in which it serves either as the diene or the dienophile or forms a dimer by combining both functions. The products from these primary reactions in many cases exhibit a high order of reactivity approaching that of acrolein itself. Acrolein seems destined for a place together with ethylene oxide, acetone and allyl chloride as a petrochemical serving almost all branches of the chemical industry.

● *The Canadian Petrochemical Industry*, by A. W. Hutchinson, R. G. Stevens, Shell Oil Co. of Canada Ltd., Toronto, Ontario.

From the inception of the petrochemical industry in the early forties, capital investment grew to 230 millions by the end of 1953. The location of plants has been governed partly by nearness to markets, but also by the discovery in recent years of large-scale reserves of oil and natural gas in Alberta and the expansion of oil refining capacity. A description is given of the origin, manufacturing operations and products of the main petrochemical plants in Canada.

● *Polyethylene*, by Robert E. Burk, Daniel E. Strain, E. I. du Pont de Nemours.

Polyethylene has won broad markets in the packaging, pipe, paper, general molding, container, and electrical fields. This results from its moderate cost, ease of fabrication, good resistance to solvents and chemicals, attractive appearance, freedom from odor and taste, good electrical properties, and other valuable properties. Intensive technical studies have shown that the properties of polyethylene can be varied by altering the proportion of short and long chain branches on the polymer chains, as well as by variation of molecular weight and molecular weight distribution.

● *Manufacture of Acrylonitrile From Natural Gas*, by J. T. Thurston, E. L. Carpenter, F. Derbenwick, American Cyanamid Co.

Hydrocyanic acid is produced by igniting a mixture of natural gas, air and ammonia on a hot platinum alloy gauze. Following removal of unreacted ammonia by absorption in sulfuric acid, the hydrocyanic acid gas is absorbed in water and recovered by distillation as an approximately 98 percent pure product. In a liquid phase reaction, acetylene and hydrocyanic acid are then combined, in the presence of a catalyst, to form acrylonitrile. The many possible side reactions and the catalyst composition are controlled. Acrylonitrile is separated from unreacted acetylene, hydrocyanic acid and other by-products by absorption, stripping and distillation operations. Thus natural gas, by a combination of four processes, is converted to acrylonitrile, a monomer of increasing importance.

(Continued on page 184)

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Technical Program

(Continued from page 180)

● *Free Radical Reactions in Hydrocarbon Chemistry*, by E. C. Kooyman, Koninklijke/Shell-Laboratorium.

It is pointed out that many phenomena in petroleum chemistry are attributable to free-radical reactions, and that it is hence important to have information on the relations between structure and reactivity of hydrocarbons towards free radicals. A number of structural factors are discussed. The important contributions of theoretical chemistry in clarifying the influence of these factors are emphasized. This general information is then applied to specific cases, such as the oxidation and the deterioration of oil products and the action of antioxidants, as well as to a number of synthesis methods in the petrochemical industry.

● *Manufacture of Chemicals From Lubricating Oil By-Products*, by F. E. Hixon, Shell Refinery and Marketing Co.

Chemicals derived from petroleum have become increasingly important, both for direct commercial application and as feedstock for the manufacture of other derivatives. In this field, chemicals manufactured from lubricating oil by-products are of considerable prominence. In this paper the methods employed for the recovery and refining of naphthenic acids, petroleum sulfonates, higher olefins and their derivatives from paraffin wax, and aromatic extracts, are discussed in general, together with their properties and applications.

● *Chemicals From Petroleum in the United States*, by J. P. Cunningham, Shell Chemical Corporation.

It is shown that the sale of hydrocarbons by the oil industry for chemical conversion in 1953 resulted in a gross return of about $180,000,000, while the total value of chemicals derived from oil and gas was of the order of $3 billion. In the field of inorganic chemicals, natural gas dominates the synthetic ammonia picture as a source of hydrogen. Five oil companies participate in the synthesis of ammonia, and their combined production has a value of the order of $8 million yearly. Natural gas is also of great and increasing importance in the production of sulfur and carbon black.

● *New Developments in Hydrocarbon Synthesis*, by Herbert Kölbel, Inst. der Technischen, Paul Ackermann, F. Engelhardt, Rheinpreussen AG.

The catalytic synthesis of hydrocarbons from gases containing carbon monoxide has been investigated by the authors in two different types of operation; one being a development of the well-known CO-hydrogenation according to Fischer-Tropsch, the other involving the direct conversion of carbon monoxide with water vapor. A feature common to both processes is that they are preferably carried out in a liquid medium. On the basis of the most recent findings, especially of a physical nature, the phenomena encountered in catalytic gas reactions in the presence of a liquid medium are described. Evidence is furnished of the particular desirability of the bubble column with suspended catalyst as used by the authors, which has also proved satisfactory in a semi-industrial demonstration plant.

● *Friedel Crafts Syntheses with Aliphatic and Hydroaromatic Hydrocarbons*, by Heinrich Hopff, Emilion Baserga, Rinaldo Roggero, Heini Bosshard, Swiss Federal Institute.

Contrary to the behavior of aromatic hydrocarbons aliphatic and hydroaromatic hydrocarbons react with carbon monoxide in the presence of anhydrous aluminium chloride with formation of ketones. The present paper describes new Friedel-Crafts reactions with aliphatic and cycloaliphatic hydrocarbons, especially with phthalic acid anhydride and sulfur.

● *The Petrochemical Industry in Italy*, by Giulio Ballabio, Soc. Montecanti.

The Ferrara factory represents Italy's first outstanding achievement in chemical production from petroleum and natural gas. Construction of the new plants began in 1950, and many are already in operation, while others are under construction or are being planned along lines well abreast of the rapid improvements and developments in this industry. The most important plants already in operation are those for polyethylene (capacity 8,000 tons per year); polystyrene (capacity 8,000 tons per year), isopropyl, butyl and isobutyl alcohol; acetone, dichloroethane, dibromoethane and ethyl chloride; plasticizers for polyvinyl chloride and terylene.

● *Dehydrogenation of Secondary Alcohols in Liquid Phase*, by F. Coussemant, Inst. Français du Pétrole.

The dehydrogenation of secondary alcohols has led to research and industrial operations for the purpose of producing the corresponding ketones, generally by a gaseous reaction at from 400 to 450°C on catalysts such as zinc oxide. These conditions are a thermodynamic necessity, high temperatures being required to achieve a satisfactory reaction equilibrium. This thermodynamic necessity can be side-tracked if equilibrium is shifted by eliminating one of the products (hydrogene), and to make this elimination practically automatic a liquid process must be adopted. Pursuant to these studies, the Institut français du Pétrole has developed an industrial process for the dehydrogenation of secondary alcohols which can in principle be employed for manufacturing all kinds of ketones.

● *Recent Developments in the Chemistry of Olefins in Italy*, by G. Natta, Politecnico di Milano.

No preprint available.

● *Modern Methods of the Chemistry of Acetylene and Olefins*, by W. Reppe, Badische Anilin & Soda Fabric AG.

No preprint available.

SECTION V
COMPOSITION OF PETROLEUM: ANALYSIS AND TESTING, MEASUREMENT AND CONTROL

● *The Use of Ozonolysis in Oil Constitution Research*, by H. Boer, Koninklijke/Shell-Laboratorium.

It is shown that the combination of ozonolysis and vapor-phase chromatography may be applied to the analysis of polyalkylbenzene mixtures with satisfactory results. A technique is described to convert the products of the reactions between ozone and polyalkylbenzenes into volatile fatty acids; in this way each aromatic carbon atom is recovered in the form of a carboxyl group. The method compares favorably with spectroscopic methods in that it is applicable to higher boiling fractions and is less time-consuming.

(Continued on page 186)

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Technical Program

(Continued from page 184)

● *Relationship Between Sulfur Content of Crude and of Conventional Refinery Products*, by W. L. Nelson, University of Tulsa, G. Théry Fombona, L. J. Cordero, Ministerio de Minas e Hidrocarburos, Venezuela.

The total sulfur content of straight-run products, cracked gasolines and cycle stocks and petroleum coke is presented in the form of charts and tabulations, as a function of the sulfur content of crude oils. These charts may be used to estimate the sulfur content of straight-run and cracked products derived from representative crude oils if only the sulfur content of the crude oil be known.

● *American Petroleum Institute Research Projects on Composition and Properties of Petroleum (U. S. A.)*, by Albert E. Miller, Sinclair Refining Co.

The API fundamental research on composition and properties of petroleum has cost the petroleum industry around three and a third million dollars to date. The program is kept up to date and virile through the constant attention of the Project Advisory Committees. As a result of this program the industry has advanced far in knowledge of the composition and properties of petroleum. There is still much more to learn.

● *Oxidation of Mineral Oils*, by F. Pass, H. Pöll, J Zartl, Chemische Technique Institut Für Organisch.

The paper gives a survey of the anti-oxidants based on their various effects. The main types of oxygen absorption curves are illustrated and the influences responsible for the formation and the changes in the configuration are explained. The effect of ozone on various mineral oils is described in detail and the change in the oxygen absorption curves resulting from this treatment is illustrated. From the changes of the oxygen absorption curves of any oil, distinguishing indications of the basic oxidation characteristics of the original oils can be be defined.

● *High-Pressure Properties of Model Substances and Petroleum Hydrocarbons (Germany)*, by E. Kuss, G. G. R. Schultze, Inst. für Erdölforschung.

For high-polymer silicone oils the viscosity is strongly dependent upon chain length, but the dependence of viscosity upon pressure is almost independent of the degree of polymerization within the region investigated. The pressure dependence of viscosity increases greatly with the chain length for esters of ortho-silicic acid in an analogous manner as was found for hydrocarbons. Ring groups within the molecule bring about a very considerable influence of pressure upon the viscosity.

● *A Critical Study of the Oxidation Stability of Insulating and Lubricating Oils*, by Kurt K. Rumpf, Evamaria Jahn, Olwerke Julius Schlinder.

Wide experimentation with different base oils for the production of insulating and turbine oils developed a theory giving a general explanation for the oxidation behavior of these special raffinates, which, as is known, varies considerably. The discrepancy in the valuation of oils referring to these special methods is newly stressed.

● *Constitution of Petroleum Fractions*, Report on work sponsored by Institute of Petroleum.

The report describes the fractionation of a middle distillate fraction from a Kuwait crude oil, and presents structural group analyses of the eight 5°C fractions boiling between 350°C and 390°C by the n-d-M method of van Nes and van Westen. A preliminary account is also given of the isolation of three tri-methylnaphthalenes from the Trinidad gas oil and of di- and tri-methyl substituted anthracene and phenanthrene derivatives from Kuwait gas oil.

● *Heterocyclic Sulfur Compounds*, by G. Roberti, consultant to E. N. I., R. Onesta, A. Ferretti, Laboratorio Chimico Centrale AGIP.

Four cyclic sulphides have been synthetized and a few physical properties have been determined. The infrared spectra are also given. The mercury chloride complexes have been prepared and their melting point is given.

● *Analytical Research on Italian Crudes*, by G. Roberti, E. N. I., E. Sommariva, F. Gianni, G. Nencini, M. Taramasso, R. Tesei, Laboratorio Chimico Centrale AGIP.

Samples of crudes from the Cortemaggiore field and gasolines from Caviaga, Ripalta and Bordolano fields have been analyzed. In addition, the lighter samples have been examined with the infrared spectrophotometer, and the medium fractions by the urea adduct method. Significant differences have been found between the oils from different fields.

● *Alkylbenzenes and Aromatic Olefins in the Products of Thermal Aromatization of Naphtha*, by E. Gil-Av., I. Michaeli, J. Shabtai, The Weizmann Inst. of Science, Rehoboth, Israel, R. Schmurmann, E. Kendrick, Manchester Oil Refinery Ltd., Manchester, England.

The individual C_9 and C_{10} alkylbenzenes and aromatic olefins of the 150-190°C cut formed in aromatizing cracking of naphtha were determined. The aromatic olefins were converted by mild catalytic hydrogenation to the corresponding alkylbenzenes and determined by difference. Alkylbenzene analysis was carried out by a combination of silica gel absorption, fractional distillation and infrared analysis. Sixty-five percent of the cut was accounted for in terms of 30 individual hydrocarbons. The abundance of the individual C_9 compounds is compared with thermodynamic data.

● *Contribution to the Chemistry of Higher Petroleum Hydrocarbons*, by Prof. Dr. W. Fuchs, Chemisch-Technische Hochschule-Aachen.

No preprint available.

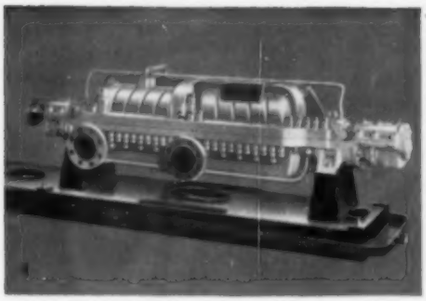
● *Viscosity-Temperature Index Scales*, by C. M. Larson, W. C. Schwaderer, Sinclair Refining Co.

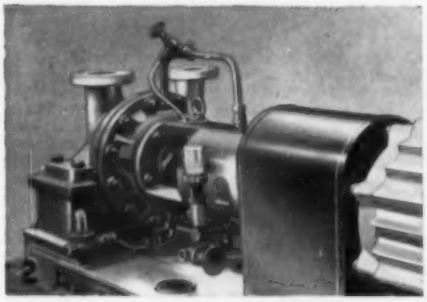
Modern petroleum research and development programs as well as practical marketing considerations require a more suitable method of expression than the Viscosity Index (V.I.) and the Pole Height. None of the many other proposed systems is wholly satisfactory. Thirty-two systems previously suggested are listed. In response to resolution No. 10 passed by the Third World Petroleum Congress, expressing the need for an improved index for viscosity/temperature relation, the authors propose an index for which the name "Viscosity-Temperature Index" (VTI) is suggested. Two Viscosity-Temperature Index Charts (A & B), illustrating two variants of the VTI scale are presented.

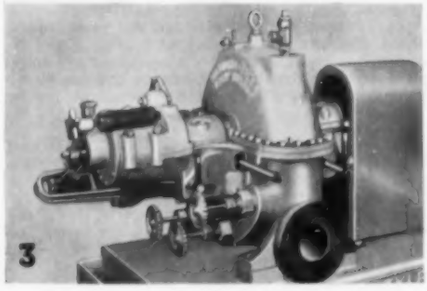
(Continued on page 188)

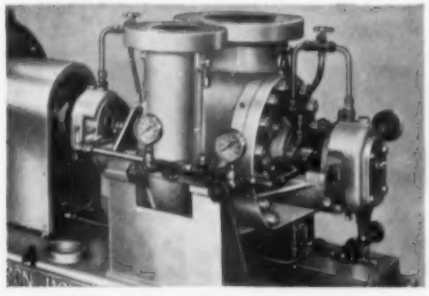
1954	Barrels per day
1. REYNOSA	7.000
2. ARBOL GRANDE	23.000
3. MATA REDONDA	22.000
4. CIUDAD MADERO	88.000
5. A. M. AMOR (Salamanca)	30.000
6. ATZCAPOTZALCO	64.000
7. POZA RICA	5.000
8. MINATITLAN	33.000
	272.000

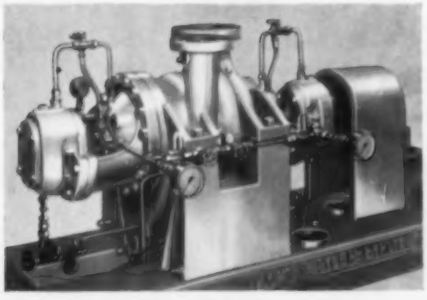
1955	Barrels per day
Reynosa	10.000
Arbol grande	44.000
Mata Redonda	22.000
Ciudad Madero	88.000
A. M. Amor (Salamanca)	40.000
Atzcapotzalco	90.000
Poza Rica	5.000
Minatitlán	50.000
	349.000











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Technical Program

(Continued from page 186)

● *New Techniques for Fractionating Heavy Products*, by A. Bestougeff, D. Bargmann, Compagnie Française de Raffinage.

A scheme of complete chemical analysis for heavy petroleum residues and for bitumens has been developed. By employing this method and new fractionating techniques it has been possible to separate and identify several distinct classes of components. The paper gives several examples of processes used. A preliminary study has been made of the ultraviolet and infra-red spectral (6-15μ) of the most complex components.

● *Review of New Developments in Analytical Chemistry*, by E. L. Baldeschwieler, Esso Laboratories.

Recent progress in the analytical field has been in the development of techniques and procedures for rapid analyses, improved accuracy and the evaluation of constituents which could not be heretofore determined. Applications of many of these newer techniques to the solution of industrial problems are discussed with particular emphasis on their use in the petroleum field. The time savings obtained by the use of modern analytical procedures are shown. The analytical problems and requirements of industrial laboratories are discussed.

● *National and International Standardization*, by H. Hyams, Shell Petroleum Co. Ltd.

The paper indicates the petroleum testing methods and oil measurement procedures recognized and used in about 70 countries from which the information was obtained. Information is also given regarding National Standards bodies, where these exist, and the extent to which they, or other local associated bodies, participate in the production and presentation of standard methods for testing and measuring crude oil and petroleum products. The need for international rather than national methods and procedures is emphasized.

● *Analyses of Volatile Organic Compounds by Means of Vapor-Phase Chromatography*, by A. I. M. Keulemans, A. Kwantes, Koninklijke/Shell Laboratories.

The present paper gives an outline of the techniques of vapor-phase chromatography that have been developed. The flexibility of the method is illustrated by means of some practical examples taken from widely different regions of the petroleum field.

● *Belgian Study of Methods of Standardization and Analysis*, by Frits P. Malschaert, University of Ghent.

The Institut Belge de Normalisation has requested the Société Belge pour l'Etude du Pétrole to resume study of the methods entailed in specification A.B.S. No. 52, and submit proposals for standardization of all other methods of analyzing petroleum products which may appear worthy of attention. The outcome of this work is a set of Belgian standards, many of which are directly based on foreign standards widely adopted by petroleum engineers.

● *Automatic Regulation of Quartz Tube Combustion*, by M. E. Weisang, Compagnie Française de Raffinage.

An apparatus is described for sulfur determination in hydrocarbons, developed at the laboratories of Compagnie Française de Raffinage. By such an apparatus quartz tube combustion is carried out automatically. Automatization of the combustion is achieved through heating the sample to be analyzed at a predetermined rate. Results obtained are more accurate than those specified by "I.P." standards.

● *Determination of Heavy Oil Composition by Mass Spectrometry*, by M. J. O'Neal, A. Hood, R. J. Clerc, M. L. Andre, C. H. Hines, Shell Oil Co.

Analytical methods have been developed for determining both molecular-weight distributions and hydrocarbon-type compositions of heavy oils by means of mass spectrometry in combination with physical separation techniques. The descriptions of these methods and examples of their use indicate the wide applicability of mass spectrometry in the field of heavy hydrocarbon analysis and at the same time show the great detail of structural information that can be obtained through present mass spectrometric techniques.

● *Applications of Radioactivity in Petroleum Technology (U.S.A.)*, by B. A. Fries, D. E. Hull, S. B. Jones, California Research Corporation.

In exploration for new oil fields, radioactivity surveys are now correlated with geological surveys. After a hole is drilled, the rock strata are identified with a nuclear log, using both natural radioactivity and induced nuclear radiations. In pipeline transportation, radioactive tracers are used to locate lost scrapers and to identify interfaces between consecutive stocks for accurate segregation. In refining, radio tracers are used in full-scale plant equipment to study characteristics, such as levels, volumes, flow rates and patterns, and processes, such as distillation, extraction, and blending.

● *Apparatus for Determination of Molecular Weights*, by A. J. Davies, A. E. Philpotts, Thornton Research Centre.

An apparatus for the rapid and precise determination of molecular weights by the ebulliometric method is described. It employs Thermistors as electrical resistance thermometers and achieves a thermometric lag some ten times less and an accuracy some five times greater than those of Beckmann thermometers. Evidence is given that a useful proportion of commercially available Thermistors have the stability requisite for this application.

● *Variable Thickness Cell for Infra-Red Absorption Spectrometry*, by H. Powel, N. Evans, Research Station, British Petroleum Co.

A variable thickness cell suitable for research and routine work is described. It is simple in design, leak proof, has a small capacity and for cleaning purposes can be easily dismantled and reassembled without affecting the accuracy of setting. The procedure for calibrating the cell is described and some typical curves correlating absorbance and absorbing thickness are given for some hydrocarbons.

● *The Ultrasonic Velocity in the Structural Group Analysis of Petroleum Products*, by M. Baccaredda, University of Pisa.

It is possible to employ, instead of the surface tension measurement, the measurement of the ultrasonic velocity in order to determine the mean de-

(Continued on page 190)

Oil in MEXICO

New Fields Discovered in 1954

V Cardenas	Gas
Zacate	Gas
18 de Marzo	Gas
La Presita	Gas
Cabezas	Gas
Norte	Oil
Tepetzintlilla	Oil
Temapache	Oil
M. Hidalgo	Oil
La Venta	Oil
Vernet	Gas

1955

Acuatempa	Oil
Chote	Oil
V. Guerrero	Oil
I. Allende	Oil

Production

YEAR	BARRELS PER DAY
1940	44 448 193
1941	43 385 825
1942	35 148 635
1943	35 458 896
1944	38 503 346
1945	43 877 427
1946	49 532 878
1947	57 117 908
1948	59 773 244
1949	62 226 979
1950	73 881 478
1951	78 779 550
1952	78 906 527
1953	74 097 231
1954	85 230 269

To supply the increasing demands of oil products in MEXICO's fast growing economy, and to fulfill all the requirements of its continued increased industrialization, new fields are developed and additional installations are put to work each year.

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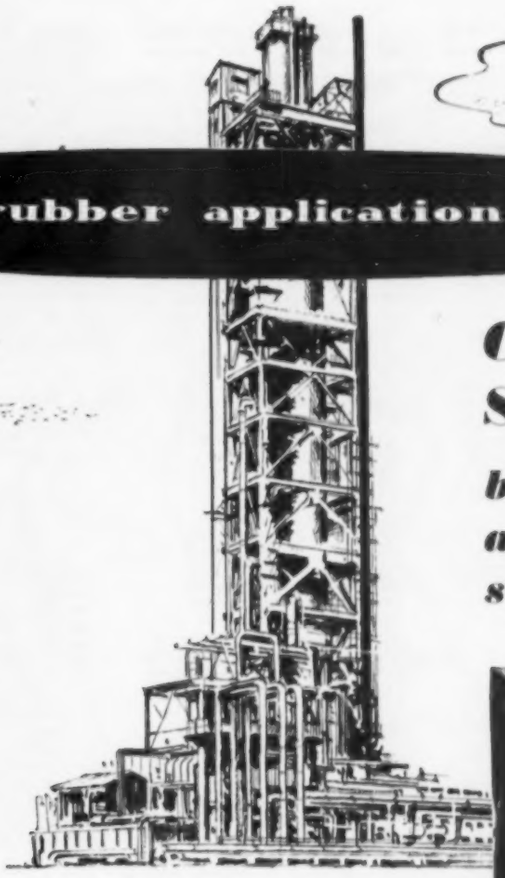

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Dunlop Oil Suction and Discharge Hose bridging the gap between pipe line and storage tank. This type incorporates high-quality, hard-wearing, oil-resistant synthetic rubber compounds, and is suitable for the severest conditions.

Dunlop Oil Suction and Discharge Hose to British Standard Specification 1435 Type 3. This 8" bore hose is suitable for use at working pressures up to 200 lb./sq. in. Photograph shows the hose at one stage of the rigorous testing programme to which every length is subjected.

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Technical Program

(Continued from page 188)

gree of branching of hydrocarbon mixtures. The ultrasonic velocity method seems to be particularly convenient for products containing impurities which may affect the surface tension.

● *Continuous Determination of water in Oils by Dielectric Constant*, by C. Guyot, Trinidad Leaseholds Ltd.

A continuous recording meter based on dielectric constant measurement has now been in use in various types of water gauging operations for some months. The paper gives a description of the latest type of instrument and an account of the results obtained with it in comparison with water determination by conventional methods. A brief account of the application of the meter to the continuous recording of the toluene content of toluene concentrate is also included.

● *Identification of Impurities in Petroleum Products*, by C. Alexanian, J. Artazoul, G. Avico, B. Bernelin, L. Boisselet, G. Chatelus, R. Courtel, A. Crozier, R. Delion, J. Favre, J. Larbre, G. Parc, A. Poussin, L. Robert, N. Tcherkezoff, Institut Français du Pétrole.

Of the subjects dealt with in our laboratories, we have chosen the identification and determination of natural and artificial impurities in petroleum products, of dopes and additives for gasolines. The authors have submitted a review of colorimetric analyses which seem best to answer these purposes. These investigations were extended to other types of dope. The limitations of the method are pointed out and some examples submitted.

● *Water Dissolved in Hydrocarbon Fuels (Great Britain)*, by P. L. Davies, Thornton Research Centre.

A new experimental method is described for determining the solubility of water in hydrocarbons. This method, in principle, measures the absorption of water from a saturated atmosphere. A theoretical study of the solubility of water in hydrocarbons suggests that Henry's law is obeyed and that the logarithm of the water solubility in a hydrocarbon is proportional to the reciprocal of the absolute temperature.

● *Analyses for Trace Materials in the Petroleum Industry*, by Harry Levin, Beacon Laboratories, The Texas Co.

SECTION VI
(UTILIZATION OF PETROLEUM PRODUCTS)

● *Mechanical and Rheological Measurements on Rubber Bitumen and Rubber Asphalt Mixtures*, by H. A. W. Nijveld, H. C. J. de Decker, H. A. O. W. Geesink, Rubber Stichting.

Various properties of rubberized bitumens are given to show that they are different from straight run and blown bitumens. In part I, research on the basic properties of rubber-bitumen mixtures is described. In part II, data are presented concerning the properties of rubber-bitumen compounds for two different practical applications, where rubber seems to be of considerable importance, viz. joint sealing compounds and pipe asphalts.

● *Bituminous Binding Agents for Road Building*, by A. Bernard, J. Lefol, Soc. des Pétroles Shell-Berre.

A widely known method of improving the adhesive qualities of bituminous binding agents to aggregates for road building and hydraulic work consists of including surface active additives in these binders. A more up-to-date method provides for introduction of the additives by direct application on the interface between the cementing substance and the aggregate. The paper reviews the technical and economical advantages of this new method.

● *Mechanical Testing of Asphaltic Bitumen*, by R. N. J. Saal, Koninklijke/Shell - Laboratorium.

This paper discusses the relation between a number of conventional mechanical tests for asphaltic bitumen and its mechanical properties. It is shown how data obtained with these routine tests may be translated into terms of stiffness and breaking strength. The conclusion is that the first four tests are valuable in their relationship to these fundamental properties, but that the value of the ductility tests is very limited and that shatter tests still need further clarification.

● *A Laboratory Study of Wax Processing Methods*, by J. L. Tiedje, Imperial Oil Ltd.

This report discusses the effectiveness of various methods for processing petroleum waxes. It is concluded that solvent recrystallization is the most efficient of these processes for melting-point separation. Recrystallization is also the only one of the above processes effective in separating high-boiling microcrystalline waxes according to melting points and is therefore the only one applicable to all types of petroleum wax.

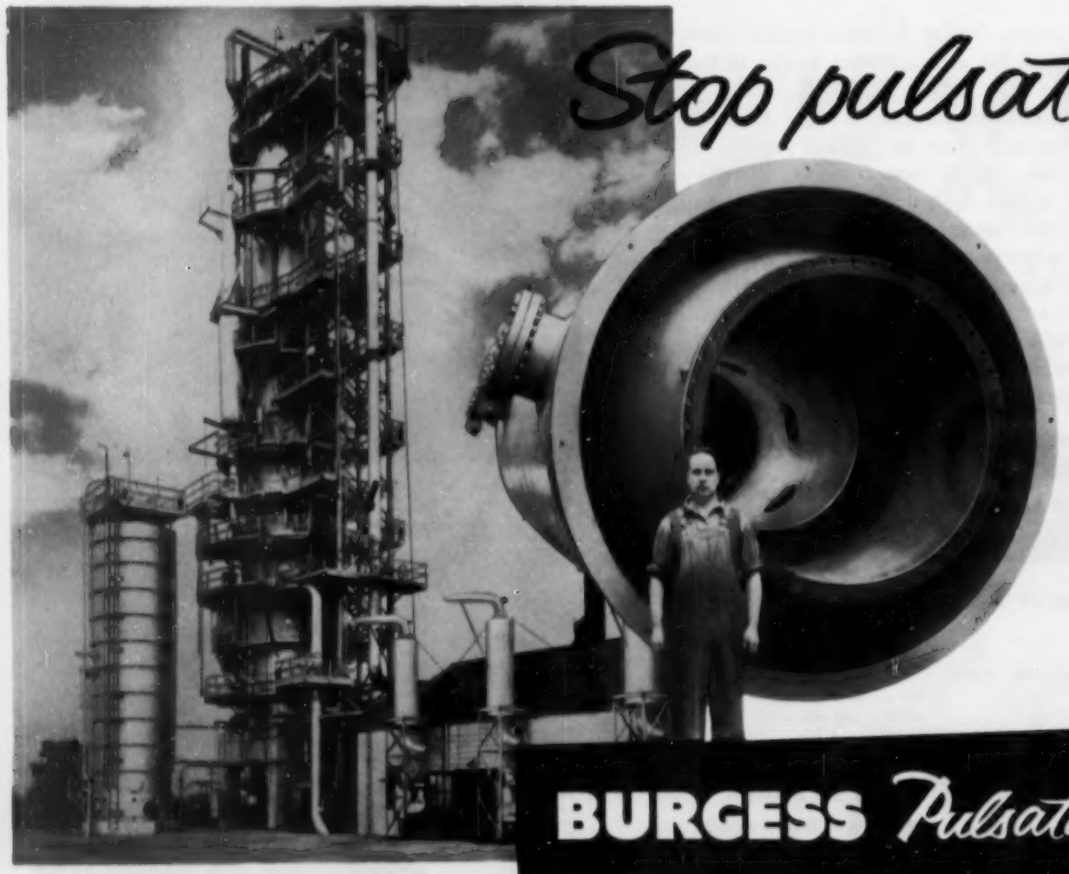
● *Fabrication of Paraffins and Petrolatums From Aramco Crude*, by M. Chauvin, Socony-Vacuum Française.

No preprint available.

● *Recent Trends in Automotive Lubricating Oil Research*, by G. H. Denison, F. W. Kavanagh, California Research Corporation.

The ever increasing load placed upon the internal combustion engine lubricant has required the research laboratories of the petroleum industry to develop a wealth of knowledge of the chemistry, physics, and engineering principles involved in lubricant performance. Skillful compounding of lubricating oils has been necessary to meet the advances made in internal combustion engine design and operation and, indeed, has contributed to such advances. To a great extent, the progress in developing improved lubricants was made possible by rapid advances in the laboratories in learning and applying fundamental, scientific knowledge. Latest types of lubricating oils give increased gasoline and oil mileage. The present paper reviews the growth of knowledge in this field and gives examples of how it was obtained.

(Continued on page 192)



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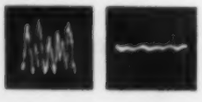

Oscilloscope recording shows pulsation (left) and smooth flow attained after fitting BURGESS Snubber (right).

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Technical Program

(Continued from page 190)

● *Developments in Dopes and Additives*, by Jacques Artozoul, Gabriel Avico, Léon Boisselet, Antoinelle Poussin, Inst. Français du Pétrole.

The paper gives some remarks on the preparation and stability of the 00, metal dialkyldithiophosphates. After referring to the commonly used methods of synthesis, and known properties, details are given of a method for salifying 00, dialkyldithiophosphoric acids with aqueous solutions of mineral salts. Heat stability as well as that of organic aqueous solutions of four dithiophosphates are specified.

● *Applications of Some Physical Methods to Lubrication Research*, by F. T. Barwell, L. Grunberg, A. A. Milne, K. H. R. Wright, Mechanical Engineering Research Lab.

The use of radio-active tracers enables extremely small amounts of transferred metal and wear rates to be measured. Precautions have to be taken when handling radio-active isotopes, but the gain in sensitivity is so great as to make this worth while. Oxide films afford some protection to rubbing surfaces. Deformed oxide layers contain crystal imperfections from which electrons can be emitted by light and registered by special Geiger counters. Deformed oxide films also produce images on photographic plates. The intricacies of the methods of modern research require a close collaboration between physicists and engineers.

● *Industrial Lubricants*, by W. A. McMillan, R. W. Hall, B. Hegeman, The Texas Co.

Greater loads, closer tolerances and faster speeds have served to increase the demands and requirements placed on lubricants for industrial equipment. The petroleum industry has kept abreast of these developments and trends and has made available lubricants which are tailor-made to satisfy all of the needs dictated by the increased demands and expanded requirements.

● *The Problem of Piston Blow-By of Combustion gases and the Evaluation of Used Crankcase Oils*, by E. H. Kadmer, H. Mauser, Mann & Hummel G. m. b. H.

The evaluation of motor field tests is preferably based on the analysis of the oils used and the determination of characteristic and extraneous aging components, correlated to the tested road distance and to the needed quantity of oil (supply and addition). In the present paper it is proposed to consider also the piston blow-by and the influence of the blow-by gases on the deterioration of the oil.

● *Some Recent Developments in the Specification and Testing of Gear Oils*, by A. Towle, Anglamol Ltd.

The paper shows how impossible it is to judge from results obtained on many of the most commonly used laboratory small scale test machines whether or not an oil is likely to prove satisfactory in service. Additive depletion has long been a topic for discussion when considering the use of treated oils and the author shows the influence of additive depletion with running time on the load carrying capacity of "multi-purpose" sulphur chlorine phosphorus gear lubricant both with respect to new and run-in gears. The conclusion is drawn that the effective load capacity of the gear and lubricant combination is not lowered by any additive depletion which may take place during 10,000 miles of passenger car operation.

● *Research on the Oxydation of Lubricating Oil*, by E. Bonauguri, G. Giusti, G. Jacini, D. Rossetti, Stazione Sperimentale.

A study is made of the behavior of lubricant oils when oxidized. During the process of oxidation the effects of corrosion, development of acidity, saponification number and change in viscosity are determined. The experimental data thus acquired form the basis for establishing correlations founded on a variable including the naphthene content of the oil and the mean molecular weight.

● *Viscosity Characteristics of Motor Oil at Higher Rates of Shear*, by Carl W. Georgi, Quaker State Oil Refining Corporation.

The customary laboratory methods for determining oil viscosities, and for estimating viscosities from Viscosity-Temperature Charts, are based on the premise that motor oils are Newtonian fluids. That is, that their viscosities remain constant at any given temperature regardless of the rate of shear. Unfortunately, this premise is not correct for many types of motor oils. Rate of shear may have a profound influence on oil viscosity, and many motor oils display non-Newtonian characteristics under certain conditions of temperature and rate of shear. At low temperatures and low rates of shear, the viscosities of such oils tend to be materially higher than indicated by the usual laboratory values. At high temperatures and high rates of shear, the opposite condition applies.

● *Prevention of Oil Ash Deposition by Means of Fuel Additive*, by Peter T. Sulzer, Sulzer Brothers Ltd., Winterthur.

Some methods differing fundamentally from one another, for preventing oil ash deposits and corrosion in gas turbines, are described with reference to test-rig investigations. The addition of aluminum silicates gave the best results of all the fifteen additives cited. Full-scale tests, lasting over 2000 hours, with specially prepared heavy oil, on a semi-closed cycle 20,000 kw. gas turbine installation, gave satisfactory results even under extreme conditions.

● *Deposits from the Continuous Combustion of Oil Fuels*, by A. Lewis, Shell Petroleum Co., Ltd.

The effect of different operating conditions upon the quantity and nature of deposit is discussed and also the effect of composition of the ash forming constituents in the fuel. Reaction of the deposited compounds with the collecting surface under particular conditions is shown to be related to the composition of the deposit and possible mechanisms of attack are considered.

● *Experience in Service With Gas Turbines Using Heavy Fuel Oil*, by Hans Pfenninger, Brown Boveri & Cie.

With the present state of development gas turbines have the same reliability in service as steam turbine installations. Heavy fuel oil can be used without difficulty for gas inlet temperatures up to 1200°F. The maintenance costs of these machines amount to approximately 0.025 U. S. cents/kwh. On comparison with other prime movers it is apparent

(Continued on page 194)

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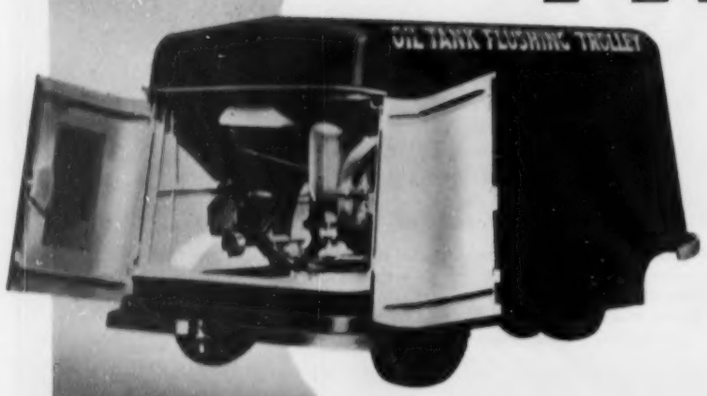

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Technical Program

(Continued from page 192)

that the gas turbine can well compete for unit outputs up to 25,000 kw.

● *The Use of Residual Fuels in Gas Turbines*, by E. B. Evans, D. M. McLean, F. R. Sharp, A. Winward, Esso Development Co., Ltd.

This paper discusses the effect of fuel oil ash constituents on high temperature deposition and corrosion and describes experimental work using both laboratory combustion rigs and a 750 kw industrial gas turbine. In the course of the work, numerous additives have been tested to ascertain their effect on the corrosion and deposit-forming tendencies of fuel oils. Magnesium, zinc, phosphorus and calcium compounds appeared the most effective and in particular the use of magnesium was advantageous.

● *Considerations on the Use of Today's Fuels in Automotive Type Diesel Engines*, by L. A. Blanc, Caterpillar Tractor Co.

The use of cracked distillate as a diesel fuel component has grown steadily over the last several years. Provided that the requirements for cetane number and other physical characteristics are met, there seems to be little difficulty in getting satisfactory engine performance. Adequate lubricating oil and oil change practice will allow good engine life. Stability in storage and freedom from engine filter clogging can be obtained by treatment at the refinery or by the use of additives now available.

● *Development of Fuels and Lubricants in Relation to Diesel Engine Requirements*, by A. Wilson, N. Kendall, L. E. Lowe, Shell Petroleum Co., Ltd.

Attention is drawn to the fact that changes in the fuel requirements of the various types of diesel engine, particularly when considered in conjunction with the needs of other prime movers, could materially affect the present balance of oil refinery operations; alternatively, considerations of optimum refinery balance could affect fuel specifications and this should be taken in.to consideration in further diesel engine development.

● *Diesel Motors, Fuels, Oils and Greases*, by Max Zwicky.

General survey of modern designs and their characteristics. Steps taken by designers permitting the use of fuels of inferior quality and the limiting conditions for the use of these fuels. The requirements for lubricating oils and their standard analytic values. Calls for a closer cooperation between designers of Diesel engines and refiners of petroleum.

● *Factors Influencing Cylinder Wear in Diesel Engines Using High Viscosity Fuels*, by C. L. Bailey, J. Withers, Sunbury Research Station.

Some of the factors which influence cylinder liner wear, and the means by which it is possible to reduce it, are studied. The effects of various fuel characteristics are examined, the use of fuel centrifuges, improved lubricating oil quality, and improved engine design features are discussed in relation to their value as means of reducing wear.

● *The Chemistry of Combustion Chamber Deposits*, by J. J. Mikita, B. M. Sturgis, E. I. du Pont de Nemours & Company, Inc.

A study of the chemical characteristics and reactions of combustion chamber deposits has yielded information on the way in which they are formed, the way in which they reach and maintain equilibrium, and the methods by which they cause preignition and increase engine octane requirement. Unburned portions of fuels and oils accumulate in combustion chambers to form a carbonaceous layer, which then traps lead oxide resulting from combustion of the tetraethyl lead. These deposits cause an increase in engine octane requirement, and can cause surface ignition of the incoming charge.

● *Effect of Fuels and Lubricants on Engine Performance*, by W. J. Sweeney, C. L. Fleming, Jr., L. E. Moody, Standard Oil Development Co.

Studies carried out at the Esso Laboratories indicate that by proper selection of the fuel and lubricant it is possible, on the average, to save 5-10% of the gasoline used in existing cars. These savings are achieved by using a high octane number fuel of balanced volatility in combination with a multi-viscosity grade lubricant. The lubricant is made from selected stocks and additives to reduce engine friction and combustion chamber deposits and give excellent over-all performance.

● *What's Happening to Automotive Engines*, by D. F. Caris, A. D. McDuffie, B. J. Mitchell, F. A. Wyczalek, General Motors Corp.

Improving the efficiency of automobile engines is one of the most important objectives of automotive engineers. Higher compression ratio, the key to efficiency, can be achieved by the use of higher octane fuel and from the development of mechanical octane numbers. Of these factors, combustion chamber design offers the most fruitful field for future development. By careful coordination of three major parameters, it is possible to make a substantial improvement in the octane requirement of automotive engines.

● *Adaptation of Fuels to Road Performance*, by R. Vichniesky, F. Kermarrec, R. Guyot, J. Weissman, Inst. Français du Pétrole.

Antiknock requirements of French vehicles and road octane number of different blends are presented in terms of primary reference fuels. Description of test methods and procedure is followed by an evaluation of the antiknock requirements of 200 vehicles.

● *Unified Concept of Combustion in I. C. Engines*, by D. Downs, R. W. Wheeler, Ricardo & Co., J. C. Street, Shell Petroleum Co. Ltd.

Each particular type of I.C. engine has its own problems of combustion. In the spark-ignition engine, in addition to the ignition and propagation of the flame across the combustion chamber, they are detonation (or "knock"), preignition and running-on. In the diesel engine the ignition quality of the fuel is important from the point of view of cold starting and noise, while in the gas turbine the problems are mainly ignition, flame stability and combustion efficiency. Although these various phenomena are distinct and are often differently affected by changing temperature, pressure and time conditions, they are all nevertheless related to the same fundamental oxidation mechanisms of the fuel.

(Continued on page 196)

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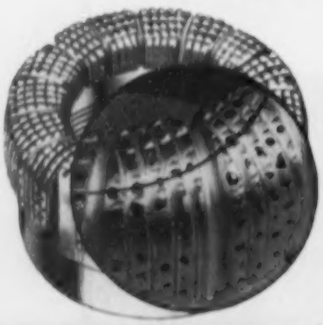

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Technical Program

(Continued from page 194)

● *Influence of Chemical Composition on Detonation*, by A. Mora, J. de la Ynfiesta, Instituto Nacional de Tecnica Aeronautica, Madrid.

A novel photographic system is used to study the maximum pressure in an engine at detonating load, and it is shown that the knock waves of two fuels with a different chemical composition but with the same octane number do not reveal the same characteristics.

● *Use of Oil Refinery Gases for Public Gas Supply*, by G. F. Rüter, Gemeente-Energiebedrijf.

In view of the development of the use of oil refinery gases for public gas supply, as for instance in the western part of The Netherlands, a review is made of how co-operation between oil refineries and public gas suppliers can be established in a way that is attractive both from a technical and an economical point of view.

● *Use of Heavy Fuel Oils in the Gas Industry*, by G. Malquori, Università di Napoli.

The paper provides a general picture and considerations on the economic and technical aspects of the gasification of residual fuels, for the production of gas interchangeable with both natural gas and the usual town gas. The author deals with technical methods of gasification in separate production plants for the manufacture of high, medium and low Btu gas.

● *Utilization of Petroleum Products and Evolution of Gas Production*, by M. R. Delsol, Direction Générale de Gaz de France.

During recent years the French Gas Industry has been consuming increasing quantities of different petroleum products, with the aim of: producing increasingly large quantities of peak load gas, improving production cost in certain areas; promoting the use of those fuels which have become progressively available through the development of the refining industry in France. The new techniques adopted or tested by the French Gas Industry concern: Production of the conventional town gas or peak load gas, by catalytic conversion of gaseous hydrocarbons such as contained in natural gas, liquefied petroleum gases and gaseous by-products of refining processes.

● *Gasification of Heavy Oils*, by H. Guillon, Office Central de Chauffe Rationnelle.

No preprint available.

TITLE ONLY PAPERS.

● *Combustion Chamber Deposits in Automobile Engines*, by W. G. Lovell, H. J. Gibson, B. A. Jones, Ethyl Corporation.

● *The CLR Oil Test Engine*, by W. G. Ainsley, Sinclair Research Laboratories Inc., A. E. Cleveland, Ford Motor Co., M. K. McLeod, Coordinating Research Council Inc.

SECTION VII

(CONSTRUCTION OF EQUIPMENT, MATERIALS, CORROSION)

● *Some Notes on Seals for Rotating Shafts*, by E. F. Boon, Inst. of Technology, S. Honingh, Philips Roxane, D. C. van Rijssen, Royal Dutch/Shell Laboratory.

This paper gives some of the results of recent investigations by the chemical equipment group of the Institute of Technology, Delft, Netherlands. It is shown that a packing, if carefully mounted after recompression, without breaking the packing ring, can give performance that approaches the theoretical optimum.

● *Refinery Engineering in Italy*, by S. Brizzi, P. Daino, R. di Monda, R. Romano, A. Salmoni, Socony-Vacuum Italiana.

This report briefly covers the Engineering Department's problems and activities of the Naples Refinery of the Socony-Vacuum Italiana, S. p. A., as an example of post-war development and organization of engineering work in the Italian refineries. With this aim a general discussion on the subject is followed by a more detailed description of the jobs performed by five typical refinery engineering departments.

● *New Ideas for Reduction of Losses by Evaporation*, by A. Champagnat, Soc. Française des Pétroles B. P.

No preprint available.

● *Alloy and Special Steels for the Petroleum Industry*, by G. R. Bolsover, J. F. Sewell, Technical Division, Samuel Fox & Co. Ltd.

A brief review of recent developments in the general fields of steels which can be of service in the production and usage sides of the oil industry. General attention is devoted to stainless and heat resisting steels, electrochemical methods of polishing, and comparisons between low carbon and stabilized steels on resistance to weld decay and the latest data on recent developments for bolts for service at high temperatures.

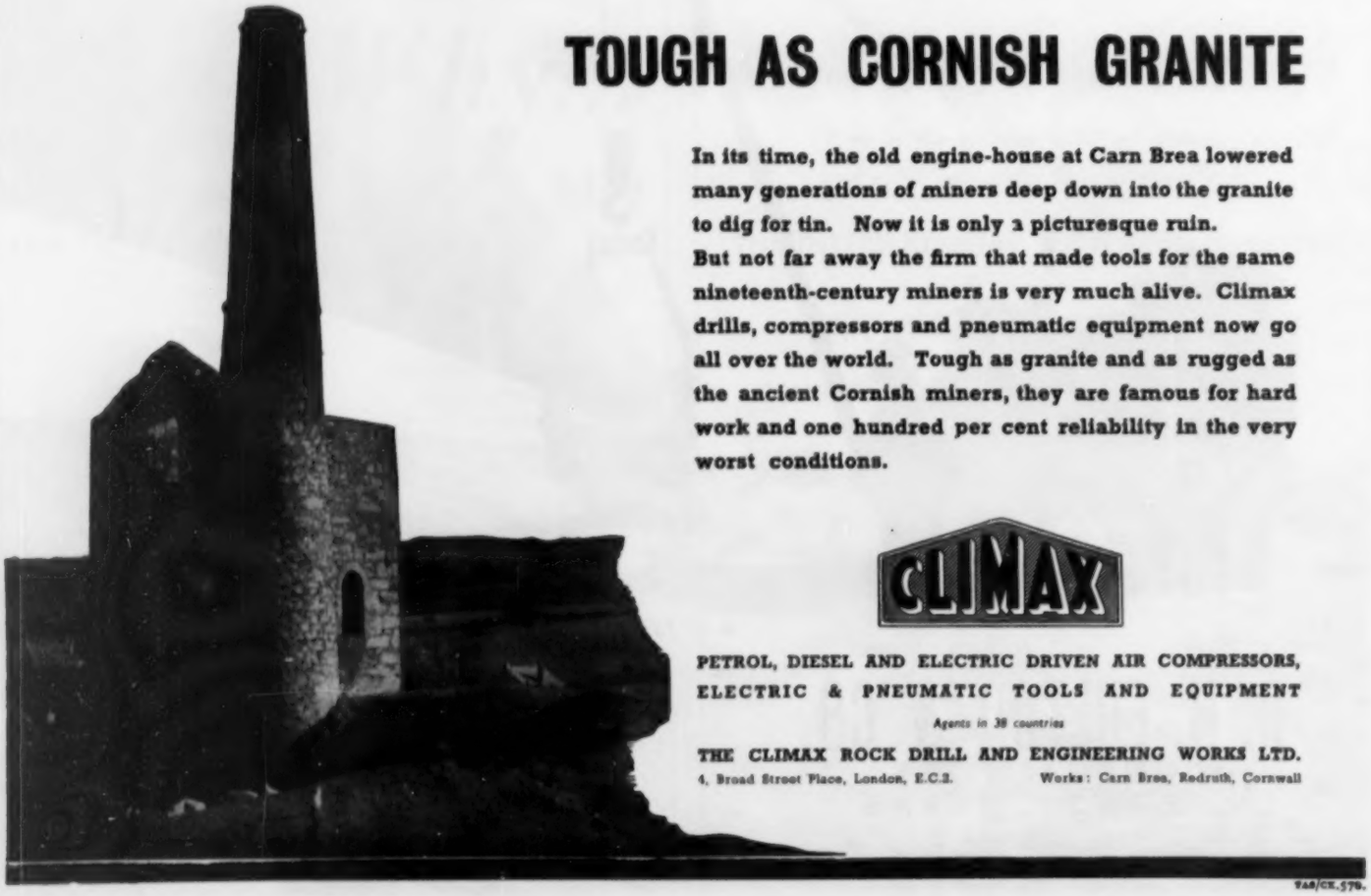
● *Properties of Refractory Steel*, by P. Villain, Sté Métallurgique d'Imply.

Having endeavored to set forth a definition of what may be termed refractory steel, the author examines the principal properties thereof and goes more thoroughly into the various items. The most widely used refractory steels are reviewed and some new applications mentioned. Present research on steels for turbojet construction will lead to further improvements in the properties of refractory materials.

● *Properties of Steel for Tank Construction*, by F. J. Feely, Jr., M. S. Northup, Esso Research and Engineering Co.

This paper covers progress to date on brittle-fracture studies being conducted in Esso Engineering department laboratories. These studies were undertaken following the failure of two large oil storage tanks in England in the spring of 1952. From the beginning of the laboratory program emphasis was placed on development of a test to simulate conditions at the time of a tank failure. The paper outlines efforts to obtain a correlation between the test results and the fundamental physical properties of the materials tested. A section is included discussing the possible future application of the test results to the design of tanks which are "safe" from brittle fractures.

(Continued on page 198)



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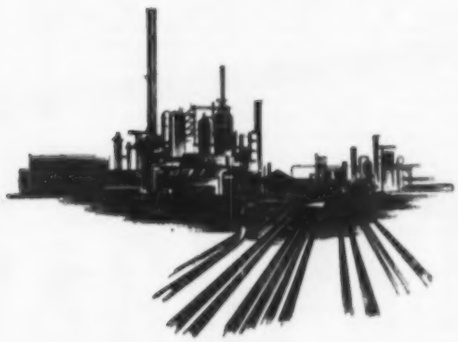

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Technical Program

(Continued from page 196)

● *Developments in the Use of Tantalum and Zirconium for the Petrochemical Industry*, by G. C. van der Wateren, Bataafsche Petroleum Mij.

The main application of tantalum in the petrochemical industry is its use as construction material for the bayonet heaters in Mantius concentrators for "black acid". A description is given of the conventional design for these heaters. Improved designs are described as well as a new method for lining vessels and tubular equipment with thin tantalum sheet and tantalum tubing. By this latter method a considerable saving in cost of heat exchangers as compared with the conventional design can be achieved. Zirconium has only recently become available on the open market. In view of the fact that this metal is much cheaper than tantalum it may be predicted that in the future it will not only replace tantalum in many cases but that it will find a relatively large field of application in the chemical industry.

● *Use of Aluminium in the Petroleum Industry*, by T. J. Peske, Northern Aluminium Ltd.

The use of aluminium in a number of different applications in the oil field, refinery, and in the distribution and marketing of refined oil products is described. The applications covered are building products, roofs for oil storage tanks, pipe lines, sheathing for insulation, instrument-air tubing, condensers and heat exchangers, catalysts, heating coils for ship tankers, containers for the marketing of petroleum lubricants, drums, anodes for cathodic protection and paint.

● *Brittleness Caused by Hydrogen*, by Paul Bastien, Pierre Amiot, Ecole Centrale des Arts and Manufactures.

After tracing the history of the phenomens of brittleness caused by hydrogen, some general ideas are submitted. The following points are then discussed: the characteristics of typical cases of brittleness; surroundings in which brittleness is likely to develop; the influence of the metal's intrinsic characteristics; the influence of the kind of mechanical stress.

● *Which Type of Steel?* by G. Liiljekvist, S. Hansen, Avesta Iron and Steel Works, Sweden.

This article is a contribution to the discussion regarding the influence of the carbon content on the properties and use of stainless austenitic 18/8-steels as well as the influence of stabilizing alloy elements. It also presents results from research work made by Avesta Jerverks Aktiebolag, Avesta, Sweden. In most cases where the use of stainless 18/8-steels is convenient in chemical industry, the application of 18/8-steels with a carbon content of maximum 0.05% can be used in thickness up to approximately 20 mm for welded vessels without subsequent heat treatment. Over this thickness steels with a carbon content of maximum 0.03% or stabilized grades should be used.

● *Le Problème des Ruptures Fragiles*, by W. Socte, Université de Gand, R. Doucet, Ingénieur Métallurgiste.

No preprint available.

● *Corrosion Inhibitors in Petroleum Processing Equipment*, by R. S. Baxter, H. H. Bennet, V. W. Hatchett, Socony-Vacuum Oil Co.

The theory of the mechanism of protection by organic inhibitors is reviewed. The advantage and economics of using this type of inhibitor are pointed out and several methods that are utilized in adding the inhibitors are described. The merits of using iron analyses of streams and test coupons are evaluated. The use of inhibitors for certain applications has permitted the use of carbon steel in place of more expensive alloys or other methods of corrosion control, and has reduced the need for neutralizers.

● *Graphite Formation in Petroleum-Refining Equipment*, by A. M. Hall, Battelle Memorial Institute.

The investigation of graphitization in refinery equipment sponsored by the American Petroleum Institute at Battelle Memorial Institute is described. Though graphite was frequently found, the number of cases in which its presence might impair the use of the equipment was not large. The extent to which graphite formation impairs the mechanical properties of steel is under investigation. This question has been studied by means of bend tests and room-temperature tensile tests. A program to determine the effect of graphitization on stress-rupture properties is now in progress.

● *Occlusion of Hydrogen in Steel*, by J. G. Wilson, W. A. Bonner, H. D. Burnham, T. Skei, Shell Oil Co.

Hydrogen occlusion in steel in oil refinery equipment containing liquid water and hydrogen sulphide may often cause severe damage to the steel in the forms of blisters and fissures. Methods of predicting and detecting hydrogen penetration have been developed. When continued high hydrogen penetration is observed, frequent inspection of the equipment is recommended. This paper describes the practical solutions to problems of hydrogen attack as well as those associated with air injection.

● *Corrosion of Underground Pipe in Urban Areas*, by Raymond F. Hadley, D. F. Van de Water, Sun Pipe Line Co.

The proper use of corrosion control permits decrease in the thickness of pipe wall. Various types of protective coatings are available for use. No evaluation of the coatings is given, but experience with specific coatings shows there are differences. Cathodic protection should always be used with protective coatings and may be used for protecting bare pipe. Cooperation between operators of underground structures is of great importance.

● *Production of Static Electricity by Movement of Fluid Within Electrically Grounded Equipment*, by A. Klinkenberg, Bataafsche Petroleum Mij.

A discussion presented of the various mechanisms that may give rise to a dangerous build-up of electric charges *within* equipment. This survey will be illustrated by an analysis of some operations that should be considered dangerous. It is pointed out that the charges may originate at any interface between a hydrocarbon oil and another material and are already present at such an interface in the absence of flow.

● *Protection of Equipment in an Oil Refinery Against Electric Discharges*, by Francesco d'Este, Irom Refinery, Venice.

One of the principal causes of fire in a petroleum refinery is static electricity. The way in which

(Continued on page 200)

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(Continued from page 198)

electrostatic charges could be produced on refinery structures and equipment is discussed and a study is presented of the consequent electric potential fields. Protection systems are analyzed, with particular regard to grounding. The formation of charges originating from the atmosphere and the potentials involved are dealt with and the protection systems, their efficiency and construction characteristics are discussed.

SECTION VIII

(TRANSPORT, STORAGE AND DISTRIBUTION)

● *Loss Control in Transportation and Storage*, by J. H. McClintock, Esso Standard Oil Co.

In this paper, an attempt is made to (a) estimate the magnitude of the actual loss of petroleum and petroleum products between the well-head and the consumer, (b) isolate these losses by each major phase of the operation, (c) indicate the sources of individual losses in each phase, and (d) propose certain basic principles for the control of oil losses in crude oil production, transportation, and refining, and in distribution and sale of the refined products.

● *The Economy of Supercarriers*, by René Gasquet, Director of Compagnie Navale des Pétroles, and Henri Deschenes, Engineer, Port of Havre.

In order to meet the increasing demand for oil tankers, shipowners have been passing orders for ships of ever increasing tonnage. But there are many factors contributing to set a limit to this tendency. The size of the tanker depends on its draught: the search for a minimum transport cost per ton-mile leads to the adoption of the solution of "economic speed" which gradually increases with the tonnage and to the fixing of the draught at about 38 feet, which is compatible with the present or future capacity afforded by the principal oil ports.

● *Recent Developments in Oil Tanker Equipment*, by John Lamb, J. W. Strang, Anglo Saxon Petroleum Co.

This paper is devoted to those parts of an oil tanker's equipment which have a direct bearing upon the handling of petroleum cargoes. After a brief comparison between pre-1939 and post-1945 tankers as regards size, speed and cargo pumping capacity, the authors give reasons for quicker turn-around in port. The delay which occurs when a tanker berths is dealt with, and proposals made to cut down this delay. Higher cargo handling rates, so necessary for quick turn-round, introduce, in the opinion of the authors, greater accident risks. To avoid such undesirable conditions they have given considerable thought to improving the relevant parts of a tanker. These are described and illustrated in the paper. Single and twin pump-room tankers are discussed and proposals made to obtain the advantages of both without the disadvantages of either. This includes an entirely new arrangement of pipes and valves in cargo tanks, which is described and illustrated.

● *Design and Operation of Marketing Terminals*, by C. R. McMillin, Standard Oil Co. of California.

The layout of facilities and the selection of all operating equipment must be such as to safeguard the products and to provide for handling them in the most expeditious manner, at a minimum operating cost. As the loading rack at a terminal is a focal point of operations, the objectives in its design are: (a) safety to personnel, products, plants and equipment; (b) accurate stock control; (c) fast loading of trucks. Accurate meters and billing by ticket printing metering devices is the most modern method to use.

● *Economic and Technological Consideration in Recent Canadian Pipeline Developments*, by F. F. Fairlie, F. C. Lantz, Imperial Oil Ltd.

The emergence of Canada as a crude producing country and its effect on pipeline development are brought into light. Pipelines constructed in the period 1947 to 1953 are described, with an outline of the major technological considerations involved, and of the main design characteristics of these pipelines.

● *Design and Construction of Underwater Pipelines*, by J. E. Green and Howard H. List, Shell Pipe Line Corp.

Three major methods of laying underwater pipelines have been developed. In the first three sections of the paper the methods are reviewed, and the Lake Maracaibo crossing, Coro crossing, and Straits of Mackinac crossing are discussed in detail. The methods employed in laying each of these lines differed radically and were determined after giving consideration to the maximum depth of water, necessity of maintaining marine traffic, velocity and direction of wind, size of waves, velocity and direction of water currents, incidence and severity of storms, bottom conditions, equipment available, and probable least cost.

● *Pipelines for Viscous Fuels*, by P. E. Ford, British Petroleum Co. Ltd.

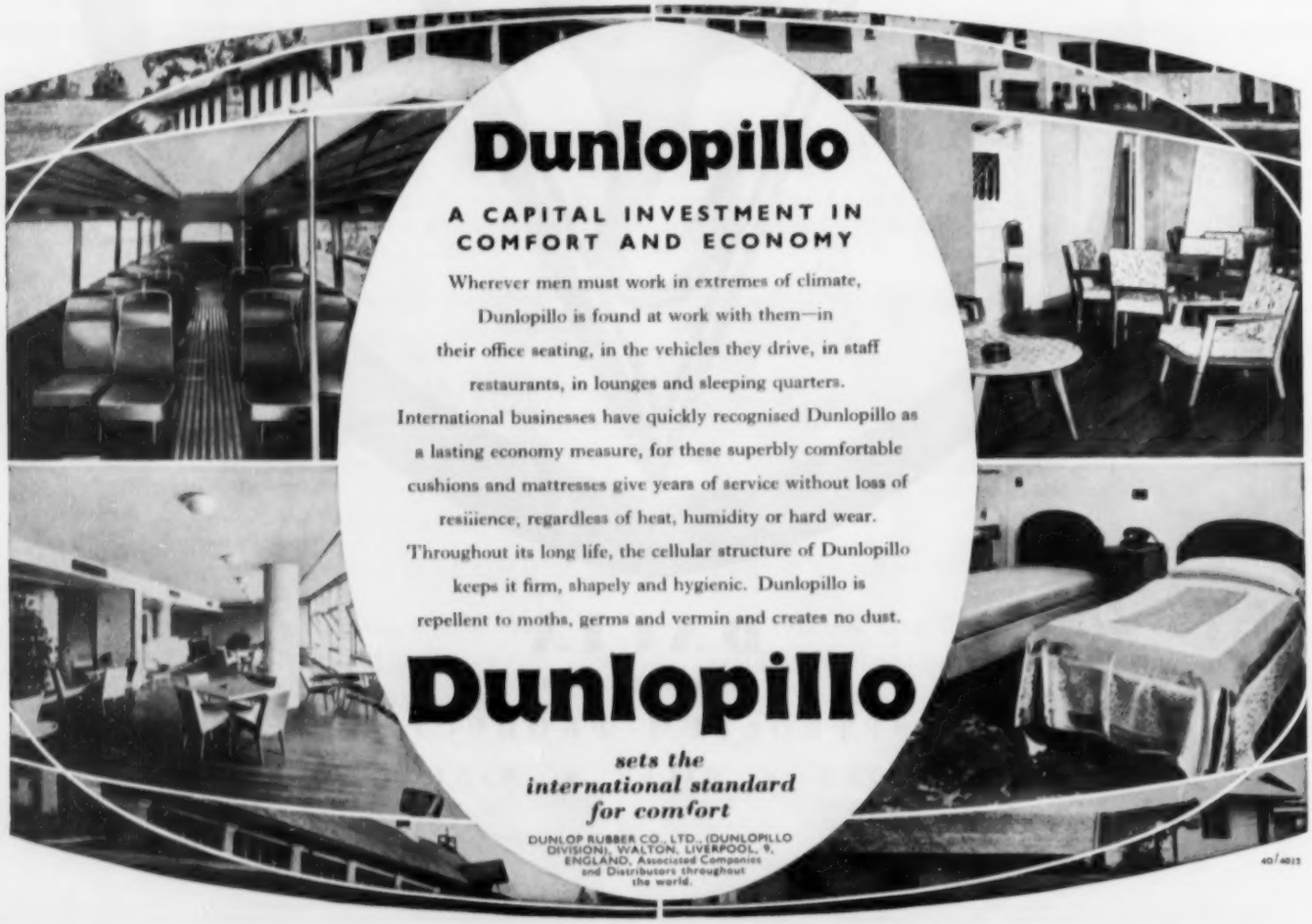
This paper deals with the results of recent investigations into the transport of viscous fuel by pipeline and how the experimental data obtained may be applied to pipeline design. In general the non-isothermal flow which is encountered in the pipelining of viscous fuels is discussed and design data obtained from large scale field trials on the heat transfer from the oil and on the pressure drops associated with this type of flow. The starting up of lines full of cold viscous oil is discussed together with some experimental data on the heating of lines by internal electric cable.

● *Pipelines for Transportation of Liquid Hydrocarbons and Gases in Italy*, by E. Donati, U. Biffignandi, Dalmine S.p.A.

An account of the design and structure characteristics of the Italian gas and oil pipelines is given with special regard to: thrust pressure inside the pipelines; types of tubes used and advantages of high strength 054 sD Dalmine Steel; how the problem of pipeline corrosion is conceived; how to protect pipelines from hydrocarbons; crossings of large rivers.

● *The Problem of Safety in Natural Gas Transmission and Distribution*, by Francesco Salimbeni, Società Nazionale Metanodotti.

(Continued on page 202)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Technical Program

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The criteria, which must govern the framing of preventive measures against accidents to individuals have been briefly mentioned. Preventive measures and modern trends in choice of materials, safety and control devices have been briefly mentioned in relation to intrinsic hazard. Extrinsic hazard has been discussed in greater detail in relation to environment and criteria have been set forth for quantitative and qualitative evaluation, with suggestions for a method of secondary protection. It has also been stated that it is possible to vary pressures and distances so as to keep hazard within admissible values. The problem of safety is finally examined from the economic point of view, calling attention to the fact that financial investments in safety measures are actually a saving for industry.

SECTION IX

(ECONOMICS, STATISTICS AND EDUCATION)

● *Effective Statistical Analyses for Management*, by Richard J. Gonzales, Humble Oil & Refining Co.

Analyses prepared for mangement should be designed to present the essential points quickly. A brief introduction should summarize the problem and the conclusions. The report should select and arrange data in a manner that conveys meaning quickly and clearly and should avoid massive tabulations that discourage the reader. Any oral presentation of statistical data should rely heavily on the use of charts to facilitate comprehension. How much can be accomplished will depend on the imagination and skill of the specialists in this field.

● *Education for Management in the Petroleum Industry*, by William B. Maloney, Standard Oil Co. (N. J.).

The prime essential of a manager's job is to get things done through people. The petroleum industry is especially alert to this need because of the size of investment per employee as compared with other major industries. Therefore, the understanding of human relations looms as the largest educational need for future management. Management development consists of two essential parts—selection and training. Selection methods are being studied and will be improved. Training features giving those selected opportunities for self-education by doing. The challenge of providing competent managers for a dynamic future for the petroleum industry can be met by education if that education features understanding of people.

● *The Independent Consultant and the User of Petroleum Products*, by A. L. Temby, H. A. Ruffel, Petroleum Section of Defense Standards Laboratories (Australia).

The role of independent consultant to the marketers and users of petroleum products has been taken by the Petroleum Section of the Australian Defense Standards Laboratories in the post-war years. The paper shows the valuable part that can be played in a young country with a rapidly expanding secondary industry by a laboratory functioning as a consultant to the Armed Services, government-operated munitions industries and private industry.

● *Oil and Gas Conservation in Venezuela*, by José Martorano Battisti, Compania Shell, Siro Vasquez M., Creole Petroleum, Luis Herrera F., Mene Grande Oil Co.

No serious problem exists regarding conservation of free gas, but a very real conservation problem is created by the production of a large volume of by-product gas associated with oil production. The industry is acutely aware of the problem and is continually endeavoring to obtain the maximum recovery of oil and to increase gas utilization as rapidly as the country's economy will permit. Sound engineering and efficient reservoir control measures have been voluntarily followed by the industry and optimum drilling programs have resulted in minimum existence of wasteful production practices. A comparison of Venezuelan withdrawal rates with those of the United States emphasizes the adherence to modern, efficient production principles. Although many Venezuelan oil fields are not suited to water flooding, this technique has been successfully applied in a few instances. Gas injection facilities have been installed in a much larger number of fields for purpose of pressure maintenance and a list of existing and projected plants is furnished.

● *Interdependence as the Foundation for World Oil Operations*, by Walter J. Levy, Economic Consultant.

There are four principal types of participants in world operations: the producing and exporting countries, the international oil companies, the consuming countries dependent on oil imports and, on a slightly different level, the parent countries of the oil companies. An effective functioning of the world oil economy is possible only through the joint endeavors and the continuous contributions of all the participants. In order to assure that these contributions will be forthcoming, they must of course be matched by essential benefits to each. The three most fundamental sets of conditions relevant in this connection are: (a) the recognition of interdependence, (b) the force of competition, and (c) the threat of countervailing power.

● *The Role of Fuel Oils in Europe*, by P. H. Frankel.

Unless new sources of energy such as atomic energy can play a significant role within this period, only fuel oils can fill the gap. Prices of coal and residual fuel oil in several countries are compared and it is established that current fuel oil prices make it possible for consumers to expand their use of fuel oils to a considerable extent. As the Middle East appears to have sufficient crude oil reserves to cope with the increased supply which the larger-scale use of fuel oils would involve, the problem is one of refinery economics. American and European present-day yield patterns are compared with those which may be necessitated by the increased demand for fuel oil. These future yield patterns will depend on the development of motor spirit demand, for which two estimates are quoted.

● *Limitations of the Right of Property Owing to the Laying of Methane Piping*, by Saverio Ilardi, Legal Advisor to ENI.

The writer briefly states the object of the inquiry, which consists of the study of the new legal problems concerning the conflict between the requirements of the concerns transporting gaseous

(Continued on page 204)

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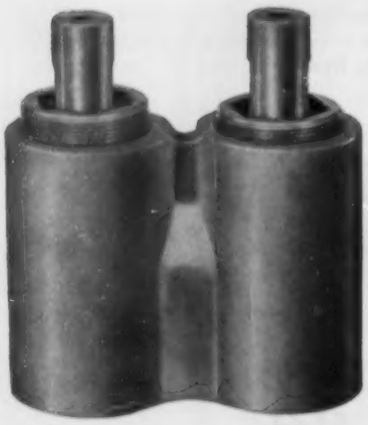

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Technical Program

(Continued from page 202)

hydrocarbons, and the rights of the individual or public administration on whose property the piping is laid. The writer then answers the question as to how the servitude of methane piping may be established, according to whether it is exercised on private or public property. The report gives information on predictions which may be made, on the ground of the new bill now in preparation, as regards future rules setting the construction and operation of methane piping. Finally, the report containes some remarks concerning the necessity of suitable amendments to the bill.

● *Utilization of Petroleum Fuels in Europe*, by W. M. Holaday, R. E. Albright, Socony-Vacuum Oil Co.

The trends in energy demand and energy sources are analyzed and compared with the past and predicted trends for the United States. Particular attention is given to the production and use of petroleum fuels. In each of the three principal fields of use, transportation, heating, and industrial operations, the factors affecting the selection of fuels are discussed. The most efficient use of petroleum fuels in each of these fields is described and a change in the pattern of European fuel use towards higher percentages of gasoline and distillate fuel and a lower percentage of residual fuel is postulated.

● *Past and Future Trends in Energy Consumption in Italy*, by D. Liotta, F. Bertolini, Esso Standard Italiana, G. Verzi, S. Gatti, Società Edison.

An interesting relationship between industrial production and energy consumption is established after a study of Italy's pattern of energy consumption in the period 1948 through 1954. In the last part of the paper an endeavor has been made to forecast on a short-term basis a pattern of Italy's requirements under a certain set of circumstances. Concluding notes indicate certain objectives that should be reached in order to reduce as much as possible the burden on Italy's balance of payments.

● *The Place of Oil and Natural Gas in the European Energy Economy*, by J. A. van den Heuvel, Energy Division OEEC.

It is estimated that, under average conditions, the development of the OEEC hydro-electric power potential will be carried out at the annual cumulative rate of six per cent, that natural gas will be produced in 1965 at five times the 1953 rate and that the consumption of all petroleum products will increase at an annual cumulative rate of five percent. Unless it will be possible to keep the price of energy within reasonable limits, Western Europe will run the danger of ultimately jeopardizing its ability to compete with other producing areas.

In conclusion, it is believed that petroleum products will take, on the energy market of 1965, a position roughly covering one quarter of the total energy requirements. Any development of overall energy demand beyond the estimates established would have to be largely met with the aid of petroleum products.

Asphalt Additives

The function and chemistry of asphalt additives were discussed by C. F. Huber and P. F. Thompson of Carlisle Chemical Works, Inc., Reading, Ohio, at the recent meeting of the Association of Asphalt Paving Technologists at New Orleans. The authors concluded that coating of aggregate by asphalt can be aided and a stronger bond produced by the aid of additives and that the surface active agents will maintain their effectiveness under adverse conditions. Copies of the paper are available on request to Carlisle Chemical Works.

Graduate Fellowships

Four fellowships for graduate students in the Department of Petroleum and Natural Gas Engineering have been announced by Pennsylvania State University. Applications are to be made to J. C. Calhoun, College of Mineral Industries, University Park, Pa. Sponsors of the fellowships are Gulf Research & Development Co., Stanolind Oil & Gas Co., Continental Oil Co. and Sinclair Refining Co.

To Manufacture Phillips Control Instruments

Phillips Petroleum Co., Bartlesville, Okla., and Consolidated Engineering Corp., Pasadena, Calif., have concluded an agreement under terms of which Consolidated will manufacture and market continuous plant analysis and control instruments developed by Phillips.

The instruments proposed for immediate marketing include infra-red gas analyzers, differential refractometers, ultraviolet analyzers, and oxygen analyzers. These electronic and optical devices have been used over the past several years in many large manufacturing plants to fill specialized requirements in the petroleum and petrochemical processing fields.

Westinghouse Tests New Jet Engine Lubricant

A new silicone lubricant with outstanding thermal and load bearing properties is being vigorously tested by materials and aviation gas turbine engineers of the Westinghouse Electric Corp.

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Diesel Engine Bulletin

Worthington Corp. has issued a new bulletin on diesel engines which presents information on construction of details, applications and latest design features.

For further information or copies address requests to Worthington Corp., Harrison, N.J., Advertising & Sales Promotion Dept., specifying Bulletin No. S-500-B42B.

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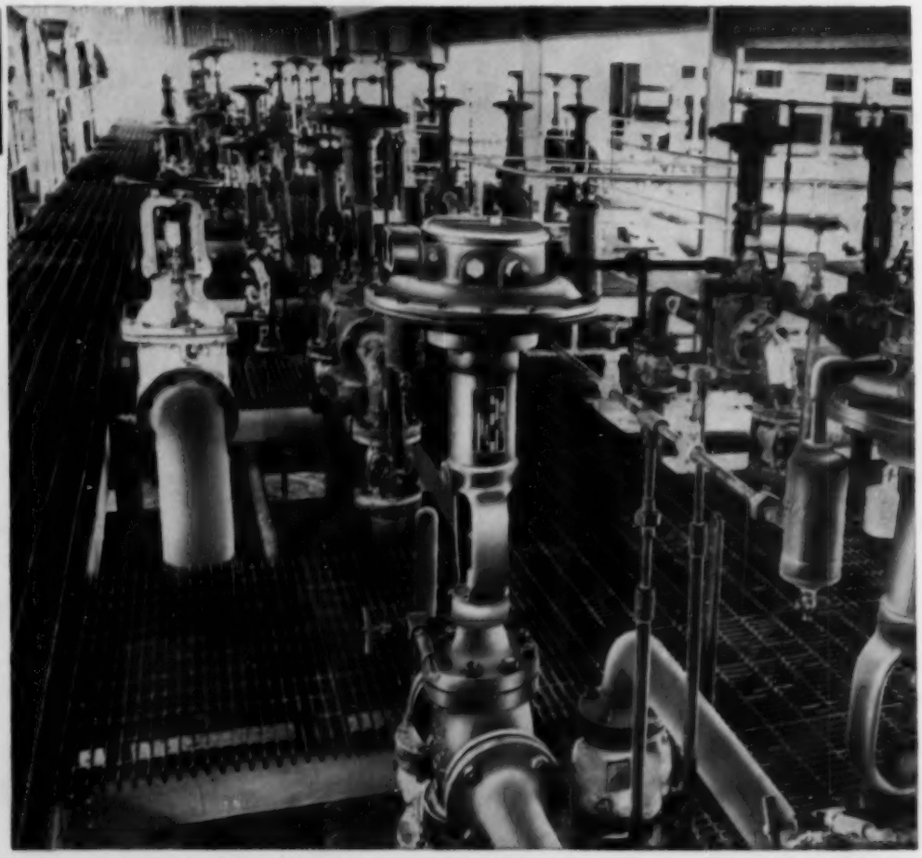

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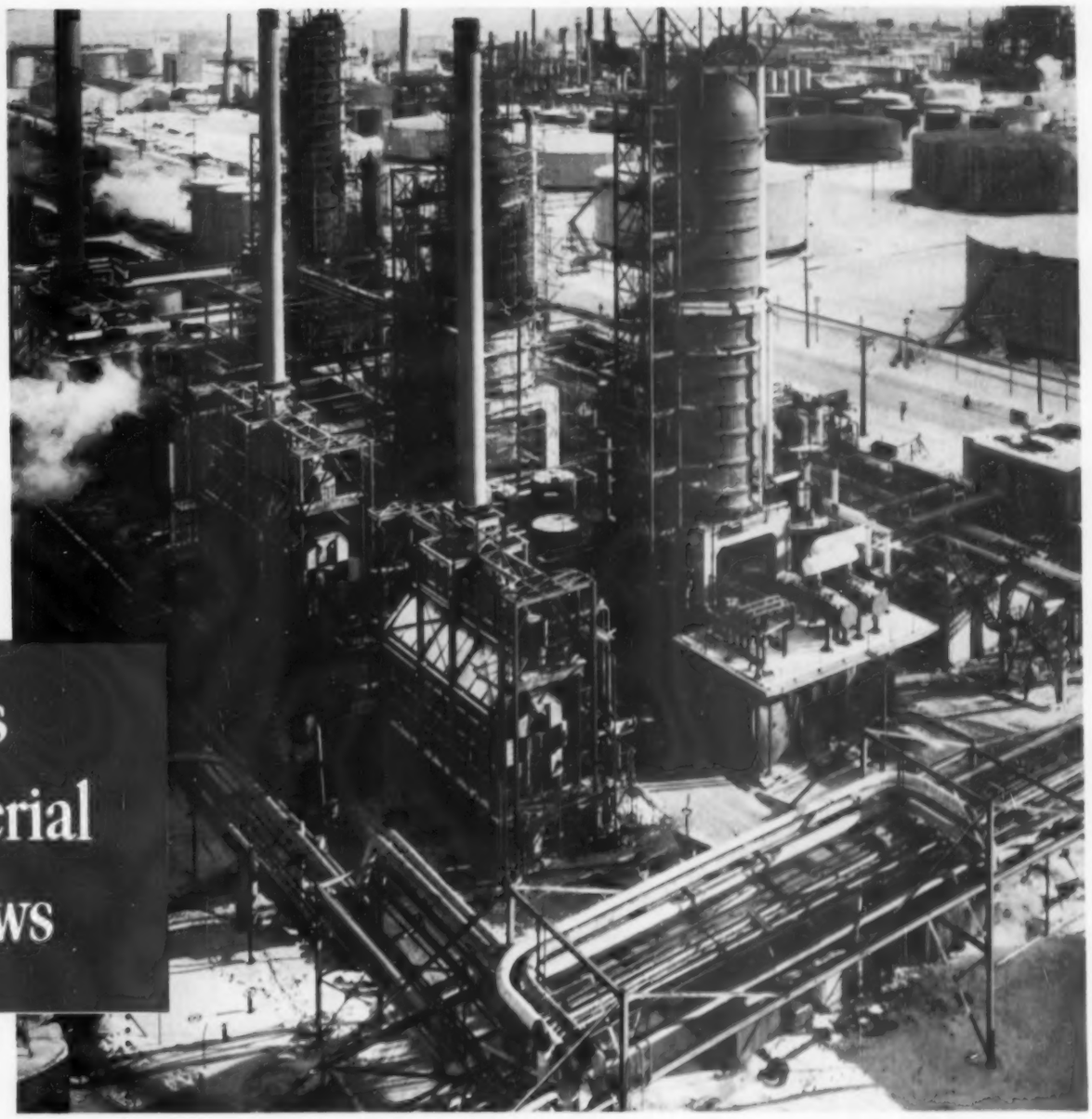

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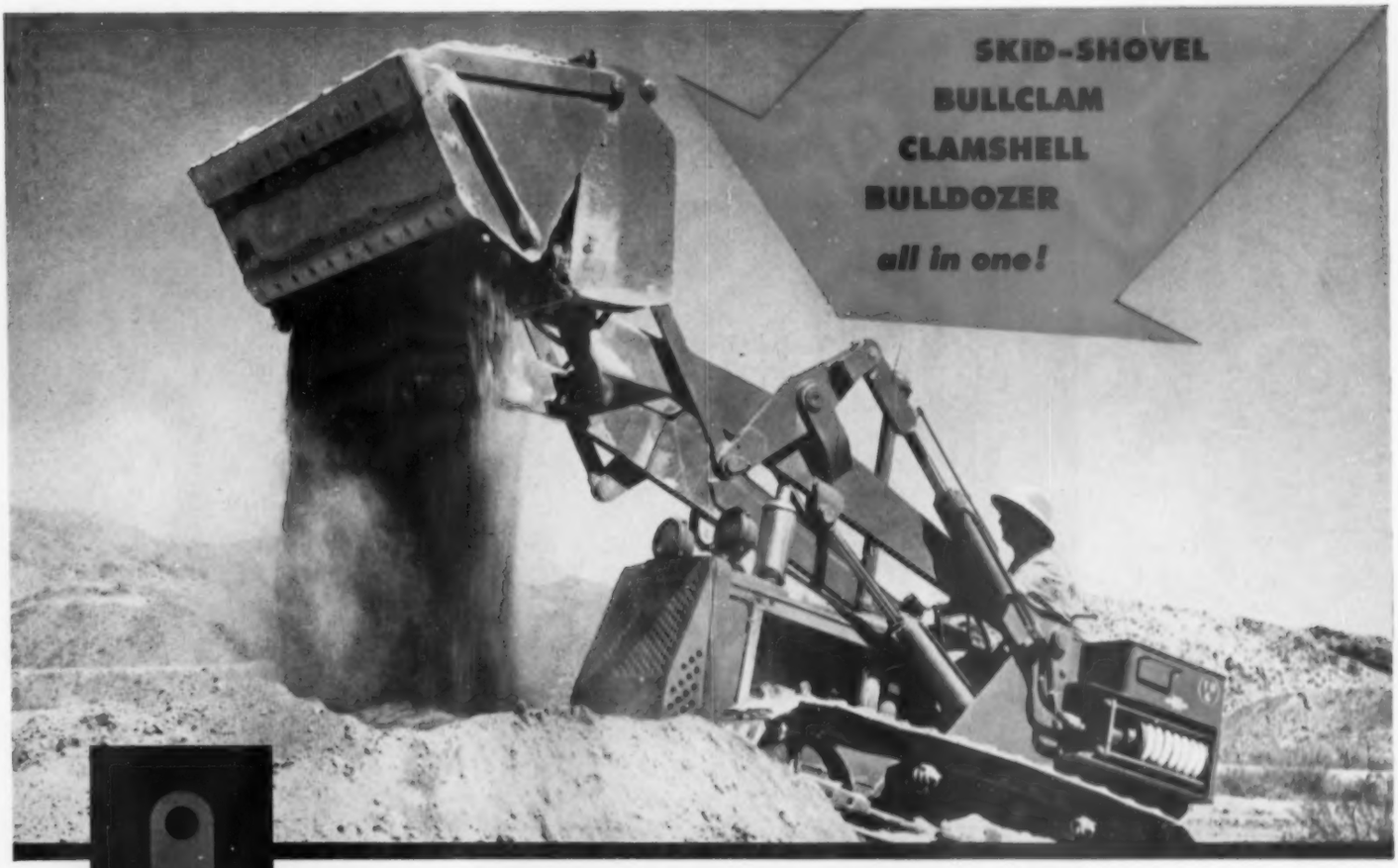

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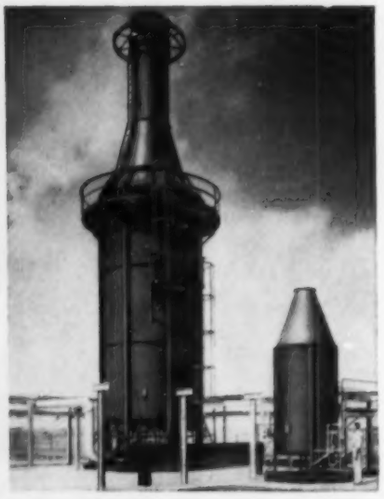

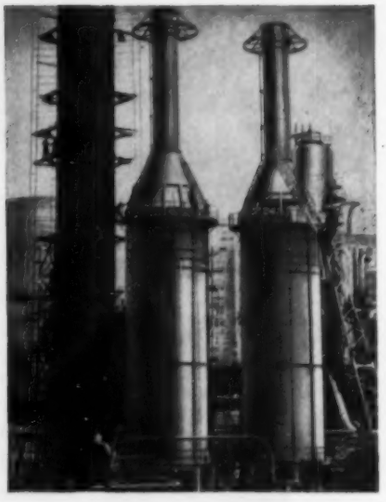

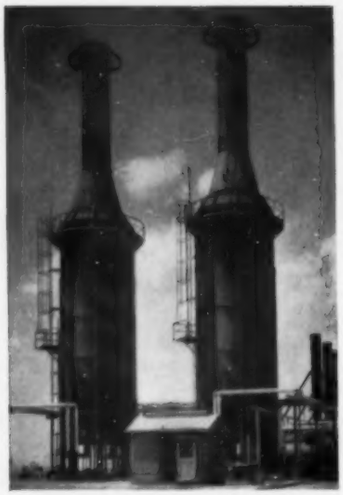
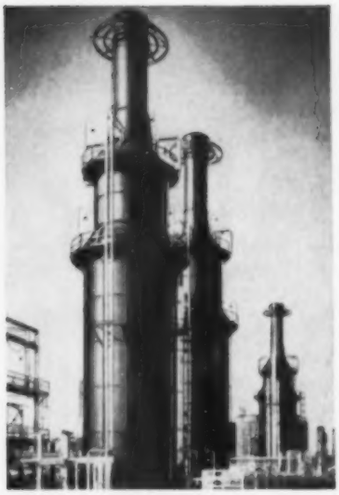

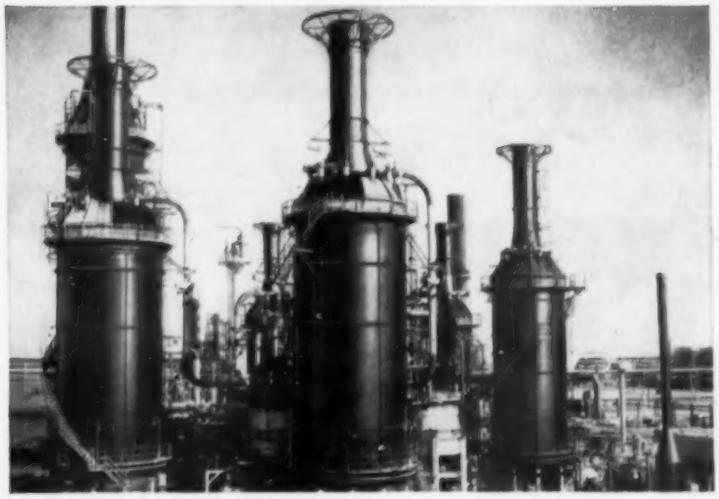
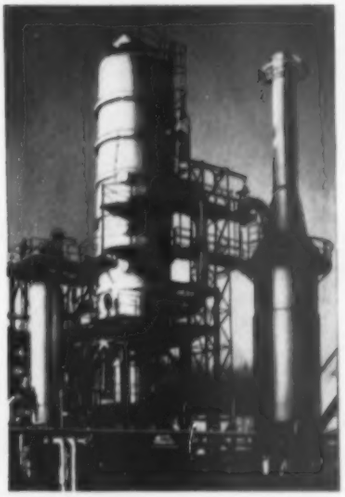

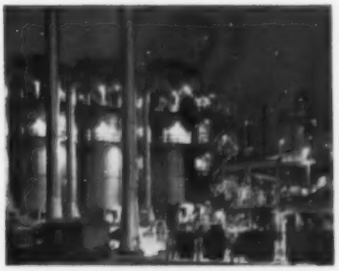

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BRITISH OIL NEWS

By E. Lawson Lomax

AN HONOR apparently without precedent in British history was paid the petroleum industry on April 5 when Her Majesty Queen Elizabeth, accompanied by the Duke of Edinburgh, made a visit of inspection to the Kent Refinery of British Petroleum Co. Ltd. The Queen and her Consort were received by Lord Cornwallis, who is Lord Lieutenant of Kent and who presented local notables including the Bishop of Rochester together with Lord Strathalmond, chairman of the company, and Lady Strathalmond.

The visit was no mere formal gesture, as the members of the royal party, after meeting senior officials and directors of the company, clocked in at the time office and were conducted throughout the plant and oil port, inspecting the equipment which was explained to them by C. S. Cleverley, general manager, and A. Patrickson, works manager. They also boarded the "British Sailor" of the company's tanker fleet which the Queen, then Princess Elizabeth, had launched in 1946 and which represented the company at the Spithead coronation review in 1953. They also visited the "British Princess," named for the tanker which brought the first cargo of crude from the Persian Gulf for refining in Britain, being conducted by R. Gillespie, managing director of the British Tanker Company, the company's marine adjunct. After lunching, the Queen unveiled the plaque in the entrance hall of the Administrative Building which commemorates the occasion of the visit.

New Type of Oil Engine

WORLD PETROLEUM'S correspondent had the opportunity recently of inspecting a new type of horizontal engine developed by Henry Meadows Ltd. as an addition to their long established line of oil engines ranging from 85 to 270 bph. It is designed to give maximum passenger capacity in road vehicles and to provide unrestricted passageways in multi-car trains. To meet the needs of oil operators whose plants have to maintain constant efficiency in parts of the world where conditions are extremely arduous, the firm has developed a power plant for operation on natural gas which is being used in oil fields for driving drilling rigs, pumps, generators and similar equipment, either directly or through a belt drive. It is self-contained and portable and automatic shutoff can be supplied where it is to run unattended. The largest unit is of 15.9 litres capacity, developing 150 bhp at 1,500 rpm. It can also be provided in a supercharged engine giving 220 bhp at 1,500 rpm. These units are in use by oil companies for drilling rigs and pumps while a further field of application is for mobile compressors and heavy duty crawler tractors. They can also be provided in conjunction with generator sets, with engine and generator mounted on a common steel base forming a completely self-contained unit.

Queen Elizabeth and the Duke of Edinburgh viewing the plaque recording their visit to the Kent oil refinery. General manager Cleverley is at left.

Stanvac's Altona Plant Opened

On the day preceding the royal visit to Kent another British Commonwealth refinery was officially dedicated. This was the Standard Vacuum Company's newly completed plant at Altona, Australia, near Melbourne. Prime Minister Robert Menzies presided at the opening ceremony, which was attended by a number of officials of the Commonwealth and of the state government of Victoria. H. F. Prioleau, president of Standard Vacuum, and Harold Rabling, a director, represented the company while M. J. Rathbone, president of Standard Oil Co. (N.J.), and G. S. Dunham, a director of Socony Vacuum Oil Co., Inc., attended as representatives of the two companies which are joint owners of Stanvac.

The Altona refinery was built by Braun Transworld Corporation of Alhambra, California at a cost of $30 million and manufactures catalytically processed high-octane gasoline, kerosine, aviation turbo fuel, diesel oils, lubricants, fuel oils and asphalt. In addition to the equipment already in operation, a catalytic Sovaformer is in course of erection and will be used to upgrade heavy naphthas to improve their octane rating.

Altona will process crudes from New Guinea and the Middle East brought by tankers berthing at Williamstown, five miles away. It is the third major post-war addition to Stanvac's refining capacity in the Eastern Hemisphere, doubling the company's 1952 manufacturing output at a cost of more than $85 million. New refineries at Durham, South Africa and Bombay, India came into operation during 1954.

Company Changes

Shell-Mex and B.P. Limited have acquired Bottogas Ltd. This company, with its predecessor Spensers (London) Ltd., has been engaged for 19 years in the distribution of commercial butane as bottled gas for domestic purposes and in the sale of related appliances and fittings. The company is continuing to operate under the same name and on the same lines as before, but changes in organization and methods may be made as time goes on.

Following the acquisition by Shell Chemicals of Petrochemicals Ltd., a new board of directors has been appointed for Styrene Products Ltd., the plastics manufacturing company owned jointly by Petrochemicals and Erinoid Ltd. Godfrey H. Owtram, E. J. Barnsley and Sir Robert Robinson have resigned and have been succeeded by A. D. Koeleman, W. F. Mitchell and L. H. Williams, all of Shell. The Erinoid directors, H. E. Harden and J. Harvey, remain on the Styrene Products board and P. C. Chaumeton continues as managing director.

Personnel

J. P. A. Meldrum and R. H. S. Turner have been appointed directors of Metropolitan-Vickers Electrical Co. Ltd. Mr. Meldrum was educated at Rugby and Glasgow University and joined the company as a college apprentice in 1926. He has remained with it continuously except for a period of service with the Royal Signal Corps during the late war.

Mr. Turner likewise joined the company as a college apprentice in 1930 after finishing a course at St. John's College, Cambridge. He has filled many managerial positions and has been works manager of the company's Trafford Park works since April 1954.

Frank Arnold Hurst, chairman and managing director of Samuel Osborn & Co. Ltd. of Sheffield, has been installed as president of the Sheffield Chamber of Commerce.

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OIL COMPANY STAFF CHANGES

J. FRANK DRAKE has retired as chairman of the executive committee of Gulf Oil Corp. He will continue as a director and a member of the finance committee. Mr. Drake has headed the executive committee for the past two years after serving as chairman of the board of directors for five years and as president for 17 years.

Mr. Drake first joined Gulf in June 1919 as assistant to the president. In 1923 he left Gulf to become president of the Standard Steel Car Co., another Mellon company. When Standard Steel Car and its subsidiaries were merged with the Pullman companies in 1930, Mr. Drake was elected chairman of Pullman, Inc.

He resigned from Pullman and returned to Gulf as president in April 1931, when the late W. L. Mellon, then president, was elected chairman. Mr. Drake was elected Mr. Mellon's successor as chairman when the latter resigned in May 1948.

J. F. Drake

JOHN F. SEAL, vice president in charge of finance and a director of Socony-Mobil Oil Co., Inc., was elected a board member of the National Industrial Board at its 358th meeting, held at the Waldorf Astoria Hotel. He will serve for a term of one year.

F. G. HALL, vice president and director of Imperial Oil Co. Ltd., has retired after 43 years of service. W. D. C. Mackenzie of Calgary was elected a director to fill the vacancy created by Mr. Hall's retirement.

Mr. Hall, a native of Toronto, started with Imperial as an office boy in 1912, became general sales manager and a director in 1945 and has been vice president since 1948.

Mr. Mackenzie, born in Macleod, Alta., joined Imperial after graduating from the University of Alberta in mining engineering in 1935. He has been manager of the western division of Imperial's producing department with headquarters in Calgary.

F. G. Hall *W. D. C. Mackenzie*

BEVERLEY MATTHEWS has been elected to the board of directors of The British American Oil Co. Ltd., Toronto. Mr. Matthews is a partner in the legal firm of McCarthy and McCarthy and a director of The Toronto-Dominion Bank, Brazilian Traction, Light and Power Co. Ltd. and other companies. He is a member of the board of governors of the University of Toronto and a past president of the Toronto Board of Trade.

DR. JOHN D. LONG, a research and design engineer of the Creole Petroleum Corp., has been appointed head of the manufacturing group in the company's New York office. He takes over the refining duties relinquished by Lloyd G. Smith, vice president of Creole, to permit the latter to devote his entire attention to his responsibilities as a director.

Dr. Long has been associated with the petroleum industry since 1933, beginning his career with the Standard Oil Co. (N.J.) in 1936 when he was employed by the Standard Oil Development Co. (now Esso Research and Engineering Co.) as a process design engineer in Bayway, N.J. He joined Creole in 1945 as technical assistant to the company's refining manager in Venezuela and was transferred from Caracas, Venezuela, to New York in 1949 as technical assistant to Mr. Smith.

Dr. J. D. Long

DAVID P. PARKER has been appointed manager of the Brooklyn refinery, Socony-Mobil Oil Company, Inc., effective June 1. He succeeds Dr. William L. Linton, who retired after 35 years of service with the company.

Mr. Parker joined Socony in March 1934 starting at its Augusta, Kansas refinery. He was transferred to the East St. Louis, Ill. refinery in 1938 and became manager of the technical engineering division at East St. Louis in 1947. Three years later he was assigned to Vacuum Oil Co., the company's affiliate in Britain, and served as manager during the construction and initial operations of the new refinery at Coryton, England until July 1954, when he returned to the company's headquarters until his present appointment.

J. G. WILLIS, Little Rock, Ark., has been promoted to Memphis division sales manager of Continental Oil Company's newly established division sales office in Memphis, Tenn. Formerly assistant manager of the company's Oklahoma City division for the past three years, Mr. Willis has served with Conoco's marketing staff since 1940 and has held a variety of marketing positions in Oklahoma, Arkansas, Mississippi and California.

The new Conoco Memphis division will include all of Tennessee, Arkansas, northern Mississippi and northern Alabama. Previously the territory was handled by the company's Oklahoma City division office.

B. L. LOUPEE, Service Oil Co., Cassopolis, was elected president of the Michigan Petroleum Association at the 21st annual spring convention of the association. He succeeds A. L. Truesdell of the J. Austin Oil Co., Wayne.

Other officers chosen for one year were: Frank Fehsenfeld, vice president, Crystal Flash Petroleum Corp.; V. H. Kellerman, secretary, Star Oil Co.; Ferris Rennie, treasurer, Rennie Oil Co.; and Joseph Hadley, executive secretary and general counsel.

CHARLES E. PAULES, veteran petroleum engineer, has been appointed a vice president of Esso Research and Engineering Co., succeeding the late Eric Luster, who died April 2. The firm is the central research and engineering affiliate of Standard Oil Co. (N.J.).

Mr. Paules has been with the company since 1919. He was the firm's chief engineer from 1949 to 1954 and had previously held the position of assistant and associate chief engineer. He served as deputy to Mr. Luster since December 1954.

Lion Oil Elects New Officers

Five new vice presidents have been elected by Lion Oil Co.: Jeff Davis, who has been secretary since 1931, was named vice president and general counsel; E. W. Atkinson, treasurer since 1943, was elected vice president and treasurer; J. B. Rogerson, formerly manager of manufacturing, was made vice president in charge of manufacturing; R. C. Tallman, research director, becomes vice president in charge of research; and J. H. Sheehan, who has been manager of petroleum sales, was made a vice president.

Other new officers elected were: B. L. Allen, secretary; R. P. Latimer, assistant secretary; and W. M. Rodman, comptroller and assistant treasurer. Other officers were re-elected.

V-TYPE ENGINES

Nordberg *Supairthermal* V-type engines are built with 10, 12, 14 and 16 cylinders, offering a range up to 5000 hp per engine . . . for Diesel, Duafuel® or Spark-Ignition Gas operation.

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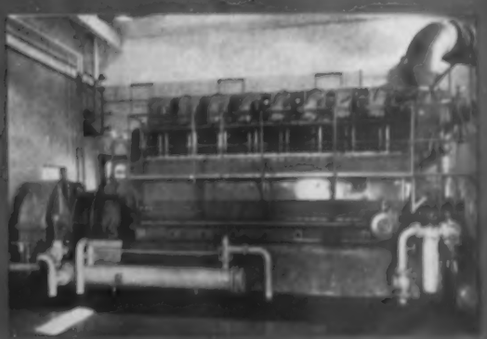

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U S S National Deoxidized Bessemer Steel Casing and Tubing — Grades H-40, J-55 are especially well suited for oil production because of their combination of high yield strength and good ductility.

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U S S National Deep-Well Casing – A stronger casing than is provided under A.P.I. specifications, to meet constantly increasing depths. Because it is intended for severe service, it is hydrostatically tested to 80% of minimum yield strength up to a maximum of 12,000 p.s.i.

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Artist's sketch of the general office building at the new Perforating Guns Atlas Corp. main plant at Houston, Texas.

Perforating Guns Atlas Corp. Builds New Main Plant

Perforating Guns Atlas Corp. formally opened a new 10-acre plant at Scott Street and Holmes Road in Houston on April 23. PGAC has outgrown two plants in the past five years due to growth in its logging and perforating services.

The new plant now comprises four buildings, providing over 26,000 square feet of floor space. The office building is a two-story structure of modern design, which will be extended later as needed. It is directly connected to the research laboratories building. Here, research in radioactive developments for the oil industry will be carried on.

Another building houses the shops in which are built PGAC's perforating guns, logging instruments and other equipment. The fourth building contains the garage and shops in which the company's trucks for field service are built and serviced.

The old plant will continue to be used by the electrical logging department and as a general warehouse until it is disposed of, or until another building is erected on the new plant site to house these departments.

Perforating Guns Atlas Corp. is affiliated with the National Cylinder Gas Co., and PGAC, in turn, has three affiliate foreign operating companies of its own: in Canada, Perforating Guns of Canada Ltd.; in Germany, Deutsch-Amerikanische Oelfeldienst, GmbH.; and in Venezuela, Servicios Técnicos Atlas, S.A.

Officers of PGAC are Paul Charrin, president; J. H. Castel, executive vice president and assistant secretary; J. W. Dunham, vice president; W. W. Whitnell, secretary; and L. Parker McKinley, treasurer.

On October 1, 1946, Mr. Charrin started the Atlas Research Corp., predecessor of the present PGAC. The original company had the modest floor area for shop and office of only 500 square feet and one employee, Mr. Charrin. A few weeks later, Mr. Castel joined the embryonic firm as vice president, the company's second employee.

Today, just 8½ years later, the company has over 430 employees working in four countries. It operates 35 stations, from which a fleet that now is fast approaching 100 logging and perforating field units serves the oil industry.

During his 20 years in the oil industry prior to establishing his own business, Mr. Charrin was assigned to service in Central Africa, the Belgian Congo, South Africa, Spain, France, Russia, Romania, Germany, Poland, Venezuela, Colombia, and Trinidad.

Mr. Castel, prior to joining Mr. Charrin in 1946, was vice president in charge of the perforating department of Schlumberger Well Surveying Corp. which he had served for 20 years. He, too, saw foreign oil and metals exploration field service in France, French Morocco, Spanish Morocco, Algeria, the Congo, South Africa, Spain, Russia and Romania.

Other PGAC executives include Cecil C. Hinson, assistant to the president, a geophysicist with 12 years of field experience who now is doing administrative work; W. L. Young, sales manager, a former Halliburton employee who joined Atlas Research in 1946; James H. Russell, manager of operations, who is also a geophysicist with years of field and research experience; Jake H. LeBus, manager of engineering, the third employee hired by Atlas nine years ago; H. Clay Waters, manager of electric logging who spent ten years with Halliburton in the logging field; and W. R. Rabson, manager of the radiation logging laboratories who has been with PGAC and predecessor companies since 1947.

The company has introduced a number of new methods and equipment items in its short history. In 1947 it introduced the Atlas bullet perforating gun and a year later developed jet shot perforating techniques. In 1949 new gamma ray instruments were developed with quantitative calibration for more precise radioactive logging of formations. This was followed in 1950 by simultaneous radiation logging utilizing the pure neutron/neutron method to avoid the faulty phenomena of detrimental gamma rays. Since that time methods have been devised for quantitative evaluation of porosity through neutron/neutron log calibration.

A four resistivity curve electrical log was announced in 1951 and today the four curves plus the SP curve are being simultaneously recorded.

In 1952 PGAC developed jumbo side wall core sampling and in 1954 the "Mighty Mouse" expendable midget gun for permanent completions was announced. Also in 1954 PGAC developed an absolute calibration standard for radioactive sources and the super-sensitive caliper logging tool for recording a continuous survey of well bore diameters.

Paul Charrin

J. H. Castel

Revised Locations For Technical Sessions

In view of the large number of registrations received for the Fourth World Petroleum Congress and for the comfort of attendants at technical sessions, the Organizing Committee decided in May to provide additional space for these groups. It was therefore arranged that Sections I, II, IV and VI would hold their meetings in four halls assigned for the purpose in the Palazzo della Civita, located at the opposite end of the drive which leads to the Congress Building. Sections III, V, VII, VIII, and IX will convene in the Congress Building as originally planned.

While the distance between the two halls is no more than ten minutes walk, continuous bus service will be maintained between the two buildings without charge.

Notes for Congress Visitors

An easy rule of thumb to keep track of your money while in Rome is to remember the number 16. One hundred lire is roughly 16 cents; 1,000 is $1.60 and 10,000 (the largest bill printed in Italy) is $16 in American money. The 100-lire note is a generous tip in normal circumstances.

• • •

If you take a taxi in Rome after 10 p.m., don't be surprised if the driver asks you for more money than the fare shown on the meter. After 10, the law permits a surcharge of 150 lire (about 24 cents). Also, there are slight extra charges at all times for more than two people, and for every piece of baggage.

• • •

Another useful tip: Don't bother to rush through lunch in order to get to the stores. Virtually all Rome shops lock their doors at 1 p.m. and do not reopen until at least 3.30 p.m. It's the normal Roman siesta, which during the hot mid-summer months lasts till 4 p.m. The rule of not being too hasty applies also to meals. The maitre d'hotel may raise his eyebrows if you appear for dinner before 8.30 or 9 p.m.

• • •

Some of the best buys for visitors to Rome are silks, leather goods and silverware. Beware of antique jewelry that isn't, and works of art that aren't.

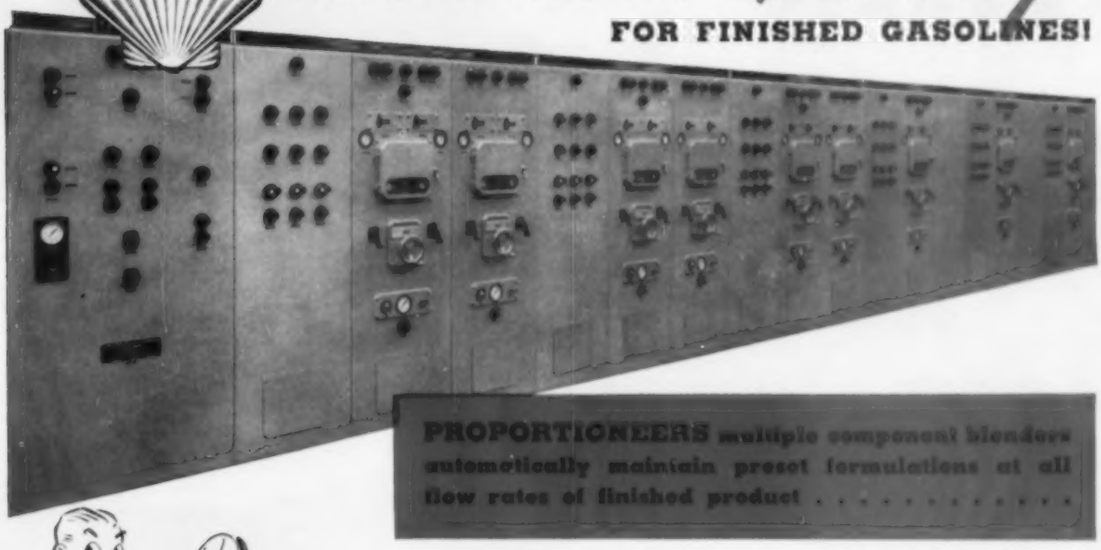
• • •

It's better to stick to official licensed guides in Rome. American Express, Thomas Cook and CIT (the Italian Travel Agency) can supply them for groups and individuals. If you have a problem, your hotel porter can handle it for you.

• • •

For atmosphere as well as good food in Rome, remember the following names: Apuleius, Capriccio, Passetto, the Hostaria dell'Orso, Palazzi, George's and Alfredo in Trastevere. All these restaurants are famous, and for after dinner coffee and brandy try the subterranean grotto of the Ulpia, which literally clings to the edge of the ancient Roman Forum.

SHELL USES *Stream Blending* FOR FINISHED GASOLINES!



PROPORTIONEERS multiple component blenders automatically maintain preset formulations at all flow rates of finished product . . . . . .

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Shell Products Pipe Line's Wood River Pump Station automatically blends six gasoline base stocks, T.E.L., dye, and gasoline additives directly to the pipe line without using intermediate tankage.

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Proportioneers equipment is used in stream blending other finished products such as solvents, Diesel fuels, lubricating oils, heating oils, bunker fuels, and asphalt cutbacks.

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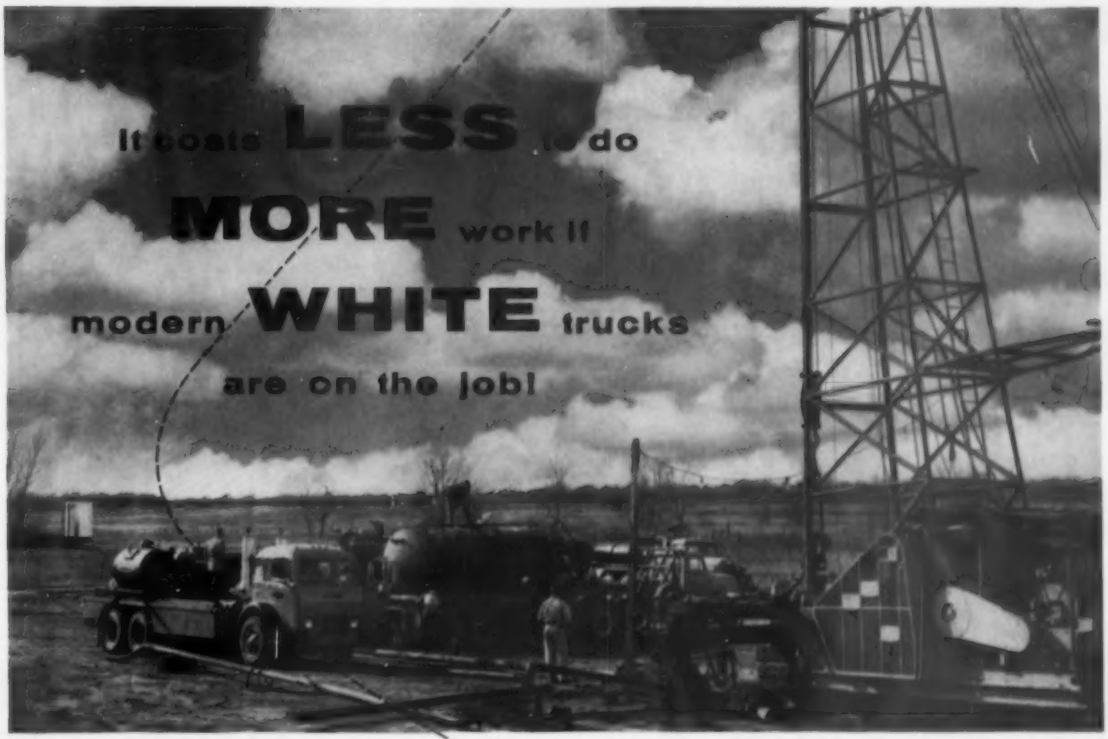

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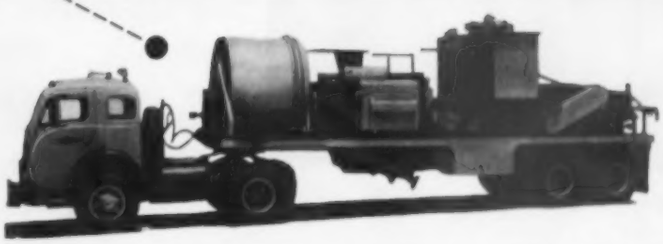

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Dowell also used Modern Whites on Chemical Cleaning Jobs

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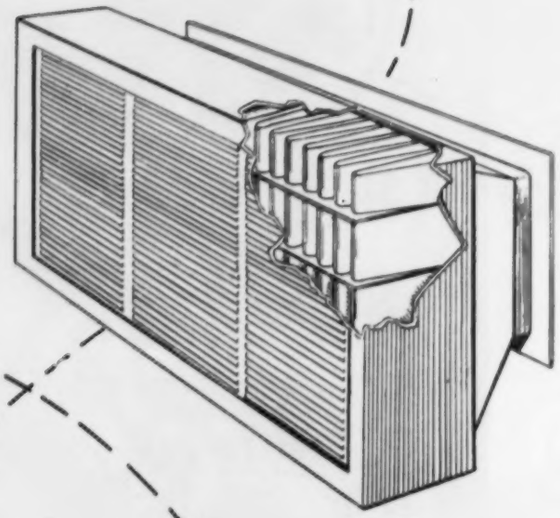

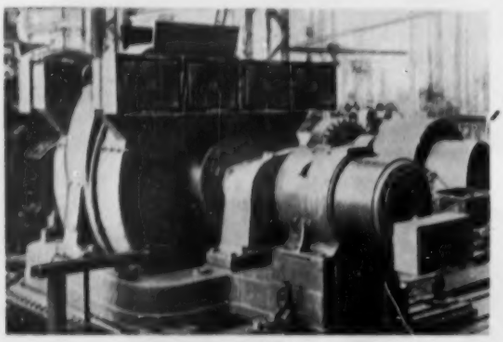

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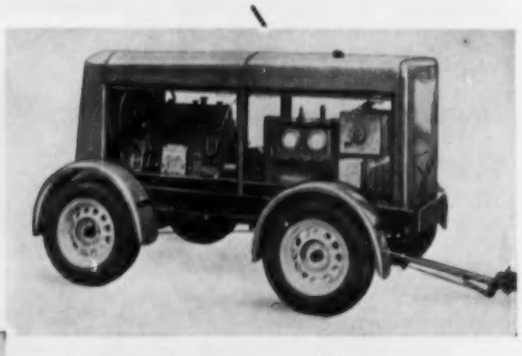

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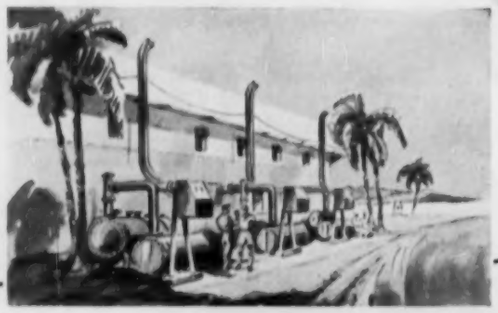

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Under abnormal conditions like these, engines have to be doubly protected and these large diesel engines are therefore fitted with Microvee dry fabric filters for cleaning the intake air. Vokes Filters are also specified for atmospheric air filtration in the ventilating systems of many of the desert buildings.

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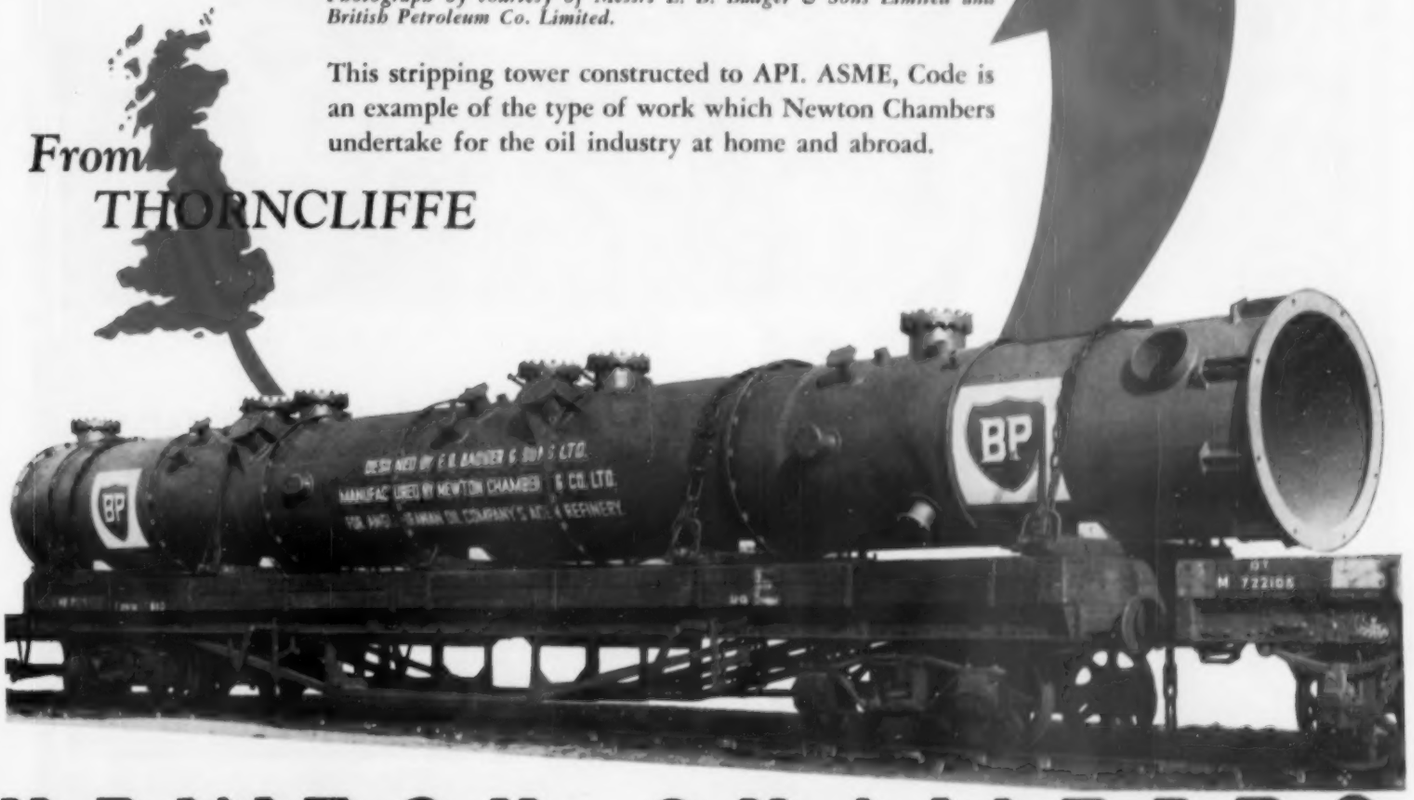
To ADEN

Photograph by courtesy of Messrs E. B. Badger & Sons Limited and British Petroleum Co. Limited.

This stripping tower constructed to API. ASME, Code is an example of the type of work which Newton Chambers undertake for the oil industry at home and abroad.

From THORNCLIFFE



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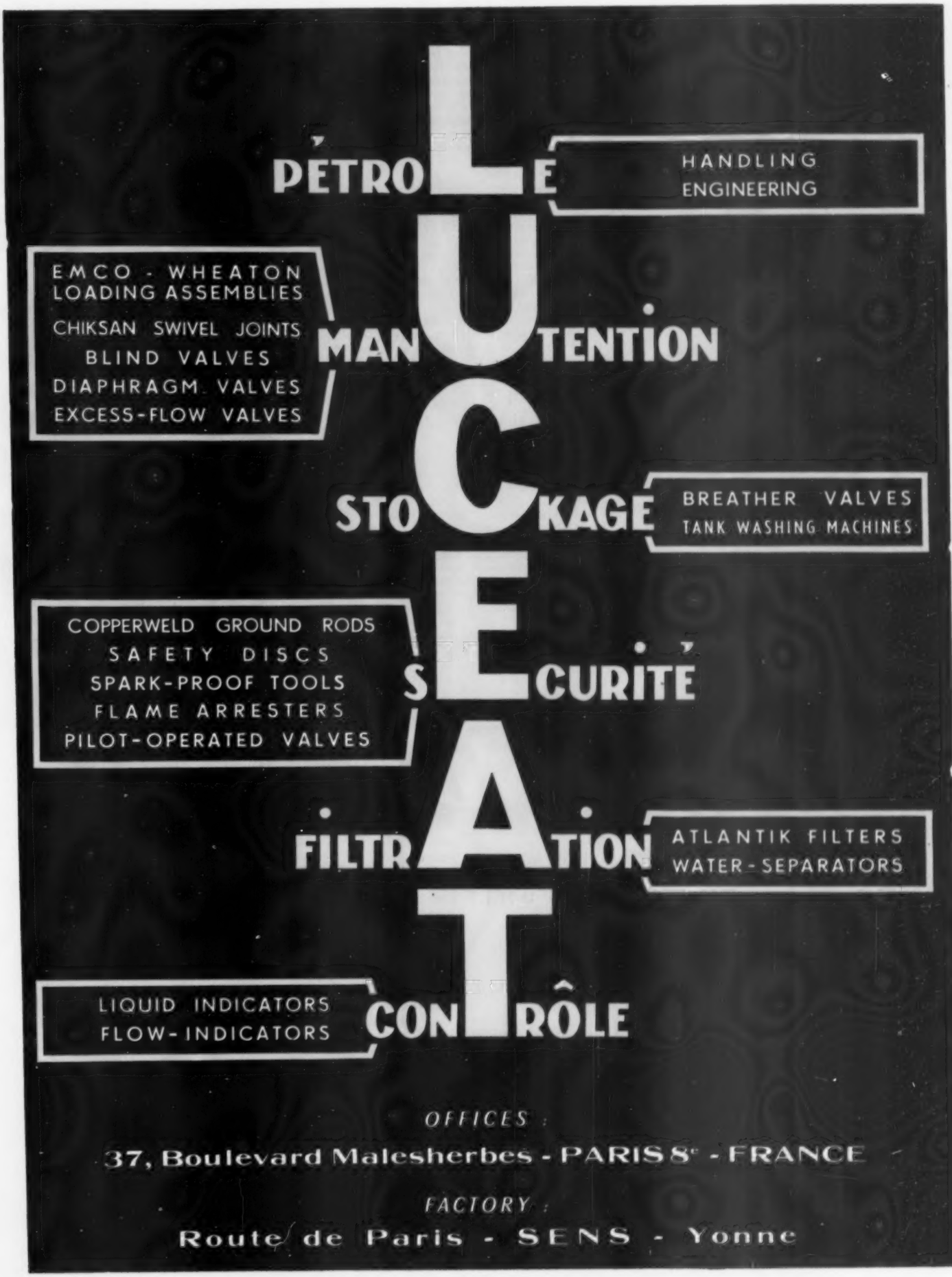
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H. R. Tate

New Graver Sales Representative

H. R. Fosnot, sales manager of Graver Water Conditioning Co., New York, has announced the appointment of Allen-Shuff Corp. of Memphis and Nashville as sales representatives. Their territory will include all of eastern Arkansas, northern Mississippi and western Tennessee from the Tennessee to Mississippi Rivers. They will handle Graver's complete line of industrial, municipal and industrial waste treatment equipment. Allen-Shuff is located at 1121 Church Street, Nashville 3, Tenn.

U. S. Headquarters in Rome

One of the busiest spots in Rome during the World Petroleum Congress is Room 41 in the Congress building at EUR. It is the headquarters of the American delegation and is presided over by genial Howard R. Tate, assistant secretary of the National Committee of the United States. Not only does his long experience in convention proceedings give him a friendly acquaintance with practically all Americans who are prominent in the oil industry, but he is an expert in the mechanics of handling technical meetings. He is the originator of many of the lighting arrangements and other features that have been adopted by the Organizing Committee to keep speakers advised of the time limits allowed for presentation of papers or discussions and also of means of enforcing these regulations if they happen to be disregarded. If you want to locate a friend who is attending the Congress, Howard's card index will tell you where to find him.

In the Venetian room of Hotel Excelsior, the American committee maintains a Women's Salon for the convenience of ladies who may use it as a meeting place with friends or to do a bit of primping or just as a rest room for tired feet between shopping trips or sightseeing tours.

Marchese Theodoli

A sad loss to the petroleum industry and particularly to the Organizing Committee of the Fourth World Petroleum Congress was the death of Marchese Teodolo Theodoli, who passed away on January 21, 1955 at his home in Rome. A graduate in engineering of the University of Rome, Marchese Theodoli was a commander of mountain artillery in World War I. After a period spent in Canada and in Texas, where he became acquainted with the oil industry, he returned to Italy as representative of The Texas Company. When that company joined forces with Standard of California in the Caltex company, he became managing director of Caltex Oil Company (Italy).

After World War II the Marchese took a leading part in the negotiations with Fiat that led to formation of Petrocaltex S.p.a. and the building of the SARPOM refinery. He served as a director of both companies up to the time of his death.

Over a period of 35 years, the Marchese Theodoli was a prominent figure in the oil industries of the United States and Italy. He was greatly interested in plans for the Fourth World Petroleum Congress and served on the Organizing Committee up to the time of his death. He was a keen devotee of athletic sports and the accompanying photograph was made last year on a golf course in France by an American friend, Robert FitzGibbon, of the Caltex organization.

Marchese T. Theodoli

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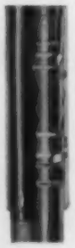
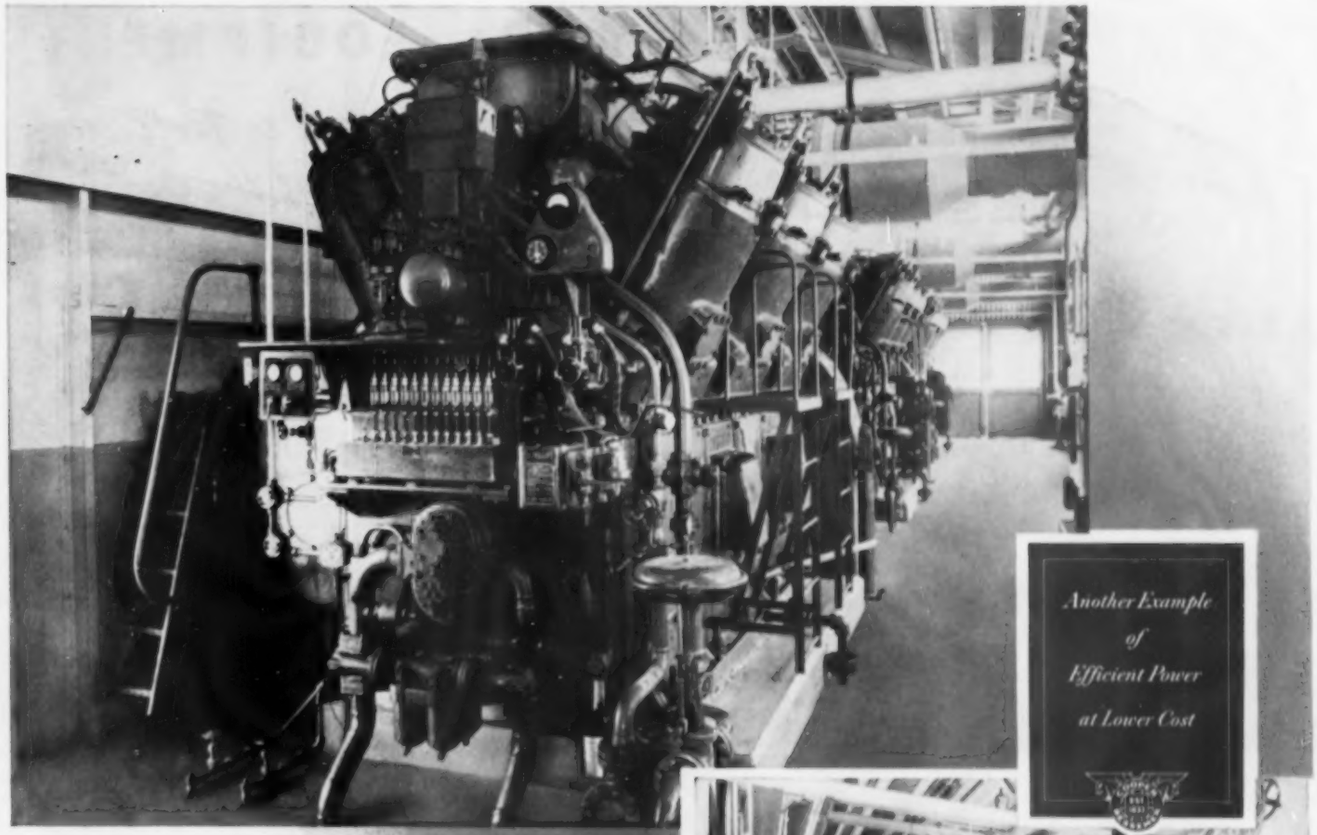
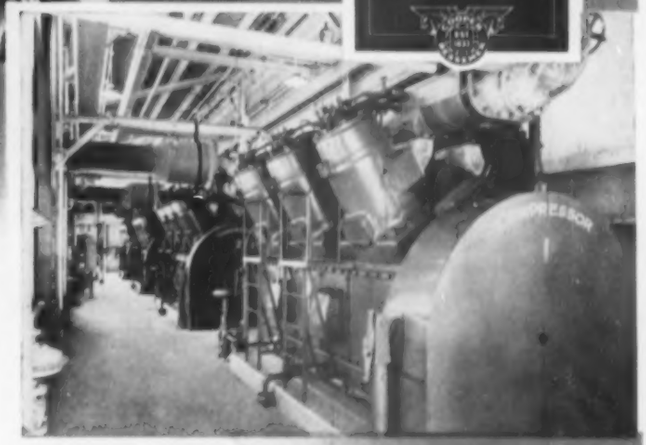




Another Example of Efficient Power at Lower Cost



Shown here are Cooper-Bessemer compressors, located at Sun Oil Company's Marcus Hook petrochemical plant. Used to handle recycle hydrogen, these four GMV's are each rated 660 hp at 300 rpm.

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• In Sun Oil's $15,000,000 petrochemical plant at Marcus Hook, Pa., three 6-cylinder Cooper-Bessemer GMV compressors efficiently handle the recycling of hydrogen, while a fourth unit is in stand-by service. Three more similar units are being added for current plant expansion.

Employing both the Houdriforming and Udex processes, the Marcus Hook installation is designed to produce benzene, toluene and mixed xylenes, or high octane motor fuel. In the Houdriforming process, it is extremely important to maintain a continuous hydrogen supply.

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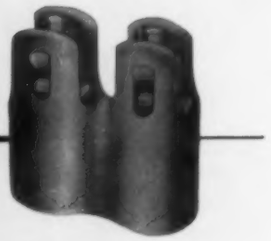

Made in association with the Ohio Steel Foundry Company to a design that incorporates the principle of directional solidification, thus ensuring sound castings giving long life.

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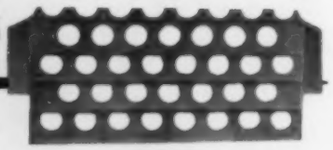

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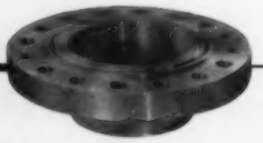

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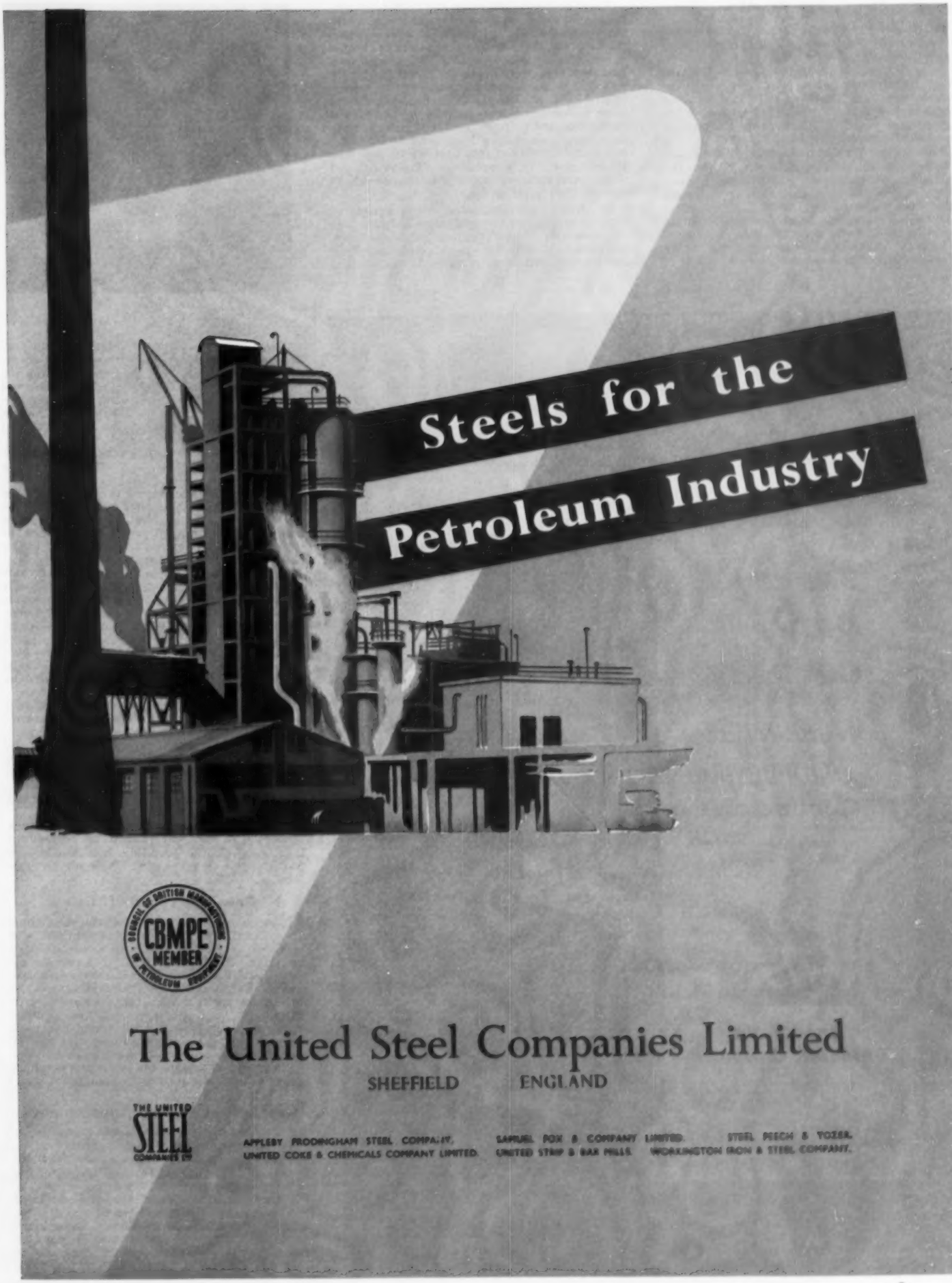
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Dr. Gustav Egloff

Dr. Gustav Egloff, 69, director of research for Universal Oil Products Co., died April 29 at Chicago following a brief illness.

Dr. Egloff was the oldest employee in point of service at UOP, having joined the organization on February 15, 1917, when the fledgling company had a small research building in Independence, Kan. He had held the post of director of research for many years.

Born in New York of Swiss parents, Dr. Egloff attended Cornell University, where he won the reputation of being an enterprising campus editor and in his long career with Universal never lost sight of the value of good press relations. He frequently startled the scientific world as well as the general public with predictions of revolutionary developments 10 or 15 years before their occurrence.

Years before nylon, orlon and dacron became household words and everyday articles of wearing apparel, Dr. Egloff predicted with supreme confidence that synthetic fibers would be created out of petroleum by-products. When such fabrics eventually were made, Dr. Egloff frequently appeared in public dressed completely in "petroleum clothing." Among other prognostications were no-dent, no-rust automobile bodies and bath tubs made from resin laminated glass fiber, gasolines that will give up to 50 miles per gallon; synthetic auto tires which will give 100,000 miles of puncture-proof service, and commercial airliners that will operate on schedules of 1,000 miles an hour.

Dr. Egloff was the author of hundreds of articles relating to the petroleum industry and the chemistry of hydrocarbons, particularly the cracking and refining of oil. Approximately 300 patents had been credited to him in the United States and abroad relating to the processing of petroleum, coal, shale oil and chemical derivatives of hydrocarbons. He was the author of a number of books, including *Thermal Reactions of Pure Hydrocarbons, Catalysis, Isomerization of Pure Hydrocarbons, Alkylation of Alkanes* and a five-volume work, *Physical Constants of Hydrocarbons.*

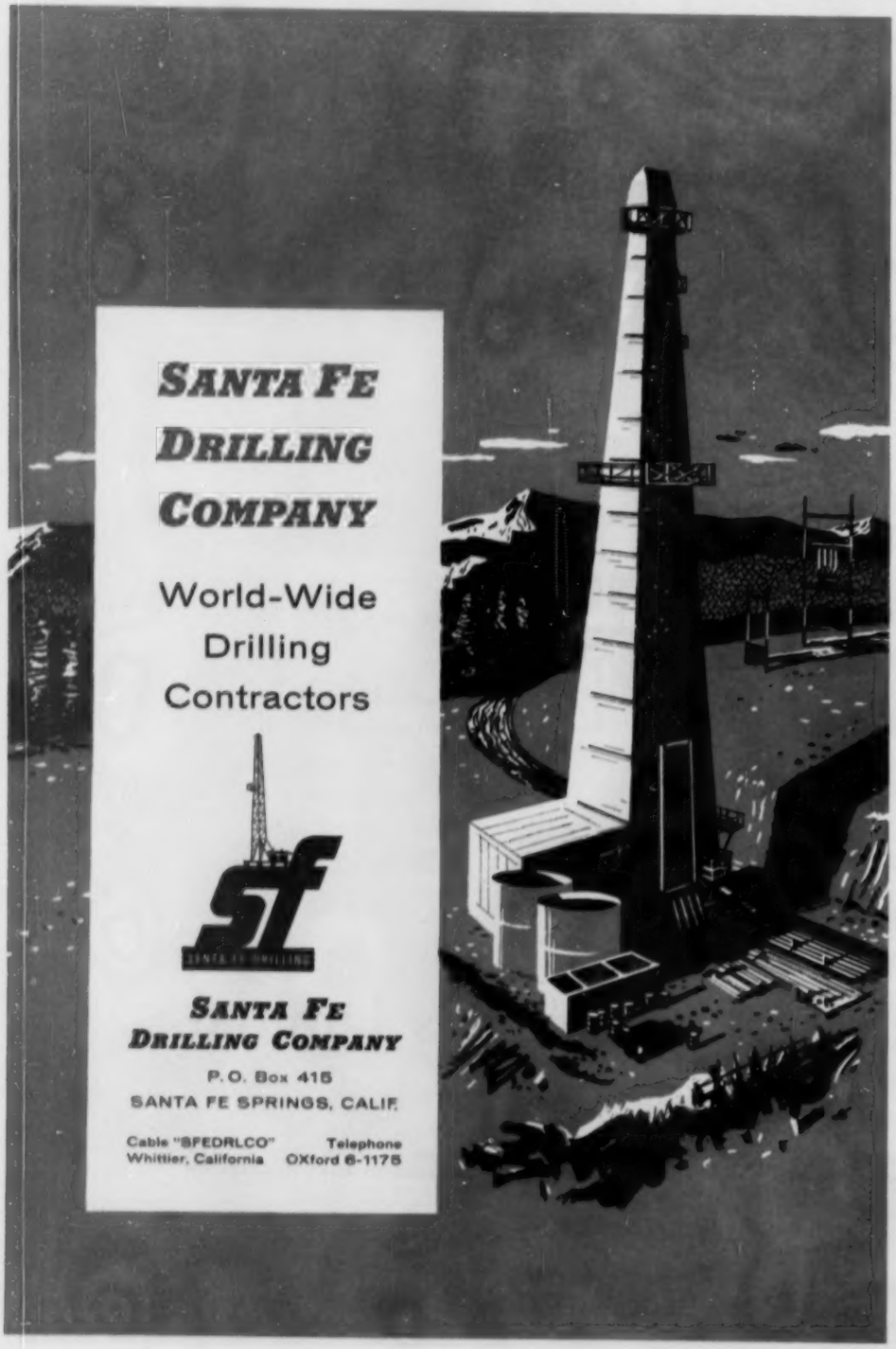
Dr. Gustav Egloff

In October 1953 Dr. Egloff was one of the three invited foreign lecturers at the 75th anniversary celebration of the Chemical Society of Japan, and was the only American to address the society. Last October he was awarded the coveted Karl Engler Medal at the German Institute of Petroleum and Coal Congress in Essen, which is Germany's highest honor in the field of mineral oil science.

Among other honors conferred upon him were the Octave Chanute Medal of the Western Society of Engineers in 1939-40; his nomination as one of the *modern pioneers* by the National Association of Manufacturers in 1940; the Gold Medal of the American Institute of Chemists in 1940; Distinguished Service Award of the National Research Council in 1941; a fellowship in the Royal Society of Arts of Great Britain in 1950, and various honorary degrees.

He was a delegate to numerous international meetings, where he presented papers concerning problems dealing with refining processes. He delivered papers at World Petroleum Congresses held in London, Paris and The Hague, and was scheduled to present a paper at the Fourth World Petroleum Congress in Rome in June. He was a member of many scientific and technical societies.

Dr. Egloff is survived by his wife, Clara (nee Mellor), who enjoyed privacy to the degree that Doctor Egloff enjoyed public life. The couple had been married 40 years. There are no children.



New Venezuela Affiliate

Paul Charrin, president of Perforating Guns Atlas Corp., has announced the organization of Servicios Técnicos Atlas, S.A., as an affiliated operating company of PGAC to serve the oil industry of Venezuela. This new firm will now provide well logging and perforating services throughout the oil fields in Venezuela, with offices at Caracas and service stations at other strategic points. George M. Yoder has been appointed manager of operations. He has 17 years of experience in field work and engineering in electrical logging, the latter part of which period he was stationed in Venezuela.

Geophysical Service Appointment

E. O. Vetter has been appointed vice president, administration, of Geophysical Service, Inc. He was formerly assistant vice president in charge of the administrative division of the Dallas geophysical contracting firm.

A graduate of the Massachusetts Institute of Technology, Mr. Vetter joined GSI as controller in 1952. Prior to that he served as assistant manager of the organization and in the cost control division of Standard Oil Company of Calif.

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0-20 Microns	9	4	2	2	2
0-30 Microns	16	11	6	5	4
0-40 Microns	28	21	12	10	8
. . . and a minimum of coarse particles					
Sieve analysis: Wt. %					
on 100 mesh (149 microns)	0	0	1	1	1
on 140 mesh (104 microns)	1	1	4	6	8
on 200 mesh (74 microns)	4	5	15	22	33

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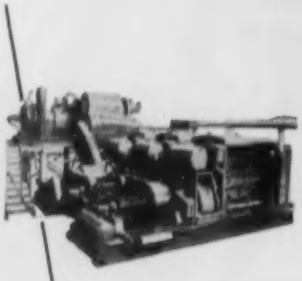

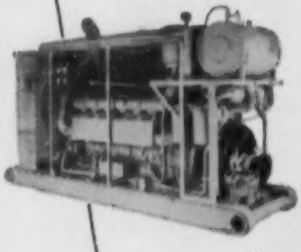

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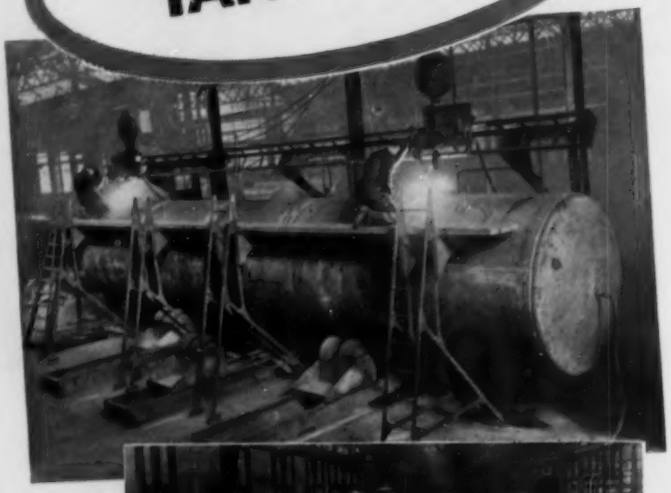

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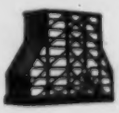

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Congratulations

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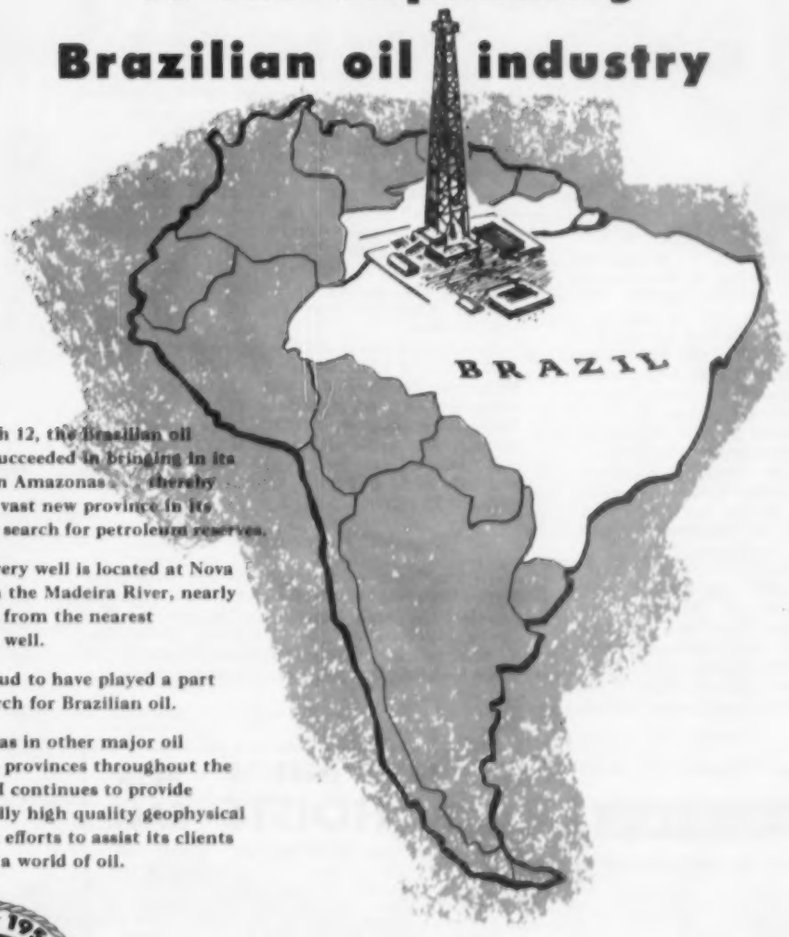

On March 12, the Brazilian oil industry succeeded in bringing in its first well in Amazonas . . . thereby opening a vast new province in its expanding search for petroleum reserves.

The discovery well is located at Nova Olinda, on the Madeira River, nearly 1000 miles from the nearest producing well.

GSI is proud to have played a part in the search for Brazilian oil.

In Brazil, as in other major oil producing provinces throughout the world, GSI continues to provide traditionally high quality geophysical services in efforts to assist its clients in finding a world of oil.

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Finding a World of Oil for a Quarter-Century

Dr. Franz Kind

Dr. Franz Kind, who died March 27 in London, was one of the first to bring the policy of "home oil refining" to Britain. He played a major part in establishing Manchester oil refinery, which came into operation in 1938. Later, in 1945, he helped to pioneer the introduction of chemicals from petroleum into Britain and a large-scale petrochemicals plant was built near Manchester.

Dr. Kind was born in 1902. His father was one of the pioneers in the manufacture of lubricating oils and his son became thoroughly acquainted with petroleum and petroleum refining in his early youth. In 1925 he graduated as a Ph.D. in Vienna and in the same year entered a small petroleum and lubricating oil distribution business in Berlin.

In 1930 he joined the banking firm of Mendelssohn & Co., of Berlin and Amsterdam, to look after their oil interests. This activity led to the erection of the first modern refinery and cracking plant in Germany at Hannover in 1930. He became one of the champions of home refining, with plants located near market centers rather than in the oilfields and between 1934 and 1938 he was instrumental in forming the Redeventza refinery in Antwerp (now called Albatros), the Aquila refinery in Trieste, and the Manchester oil refinery in Manchester. He took a leading part in the design, erection and operation of these three refineries, of which he was a managing director.

For some time Dr. Kind worked in close association with Dr. Weizmann on the development of a process for the production of aromatics and olefins by vapor phase catalytic cracking of petroleum distillates. In 1940 it was decided to build a pilot plant at Manchester oil refinery to develop the process further. The results were promising and out of this concentrated work Petrochemicals Ltd. emerged at Partington, near Manchester, as the first large-scale plant employing the "Catarole" process.

During 1948, in conjunction with leading Italian industrial and financial groups, Dr. Kind and his colleagues formed a new company: Condor S.p.A. per l'Industria Petrolifera e Chimica. This company, of which Dr. Kind was vice president, erected a refinery of considerable size at Rho, near Milan, in the heart of industrial Italy. The refinery is connected by pipe line with a sea terminal at Genoa.

Dr. Kind's activities extended to several countries and he created probably the largest group of "independent" refineries in Europe today. The success of these enterprises was based on technical perfection and on sound team-work. He was a colorful international figure, familiar at international petroleum gatherings and commanding a wide acquaintance and many friends in the industry.

Dr. Franz Kind

New Metal Cladding Method

Chicago Bridge & Iron Co., Chicago, has announced a new high vacuum brazing method for cladding metals. Hortonclad plates are produced by heating an assembly of the cladding metal and the base plate, separated by a thin layer of brazing material, while a high vacuum is produced between the two metals and a resulting high pressure is maintained on the exterior surfaces. Since no rolling is required, the thickness of the cladding is uniform and a wide variety of metals can be clad. The brazing material also serves as a barrier, preventing carbon migration from the base plate to the clad surface.

Hortonclad meets all the requirements of the ASME Boiler Code and the API-ASME Unfired Pressure Vessel Code relating to the use of composite or clad materials. Nickel-base alloy Hortonclad meeting ASTM Material specifications A-263, A-264 and A-265 is available.

Hortonclad can be readily worked by usual methods such as rolling, bending, welding and pressing.

Erratum

On the title page of the April number a color photograph was shown of a group of compressors installed at Creole Petroleum Corporation's Tia Juana repressuring plant in Lake Maracaibo, Venezuela. The caption erroneously described these as being the gas turbines which drive the compressors.

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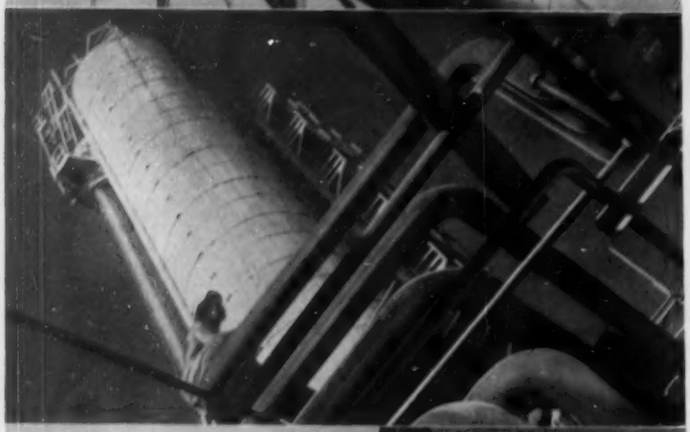

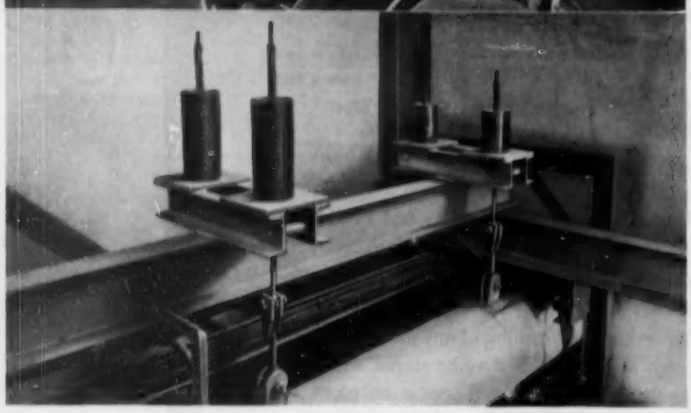

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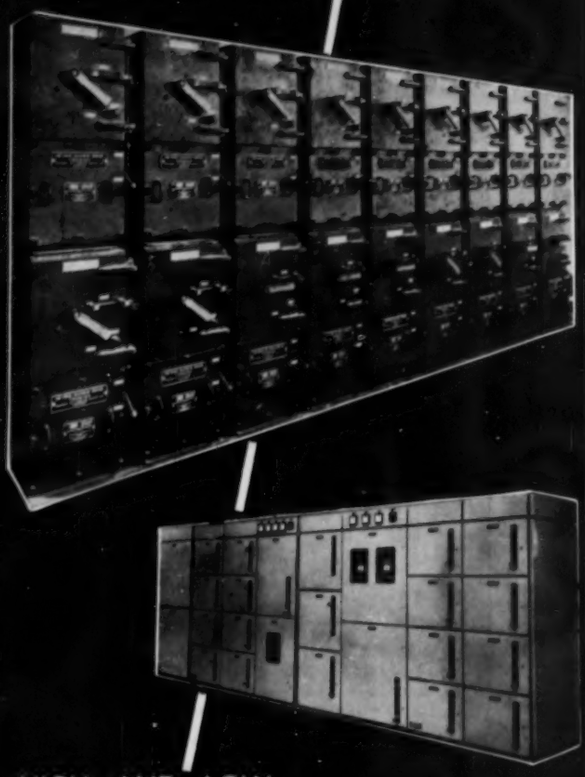

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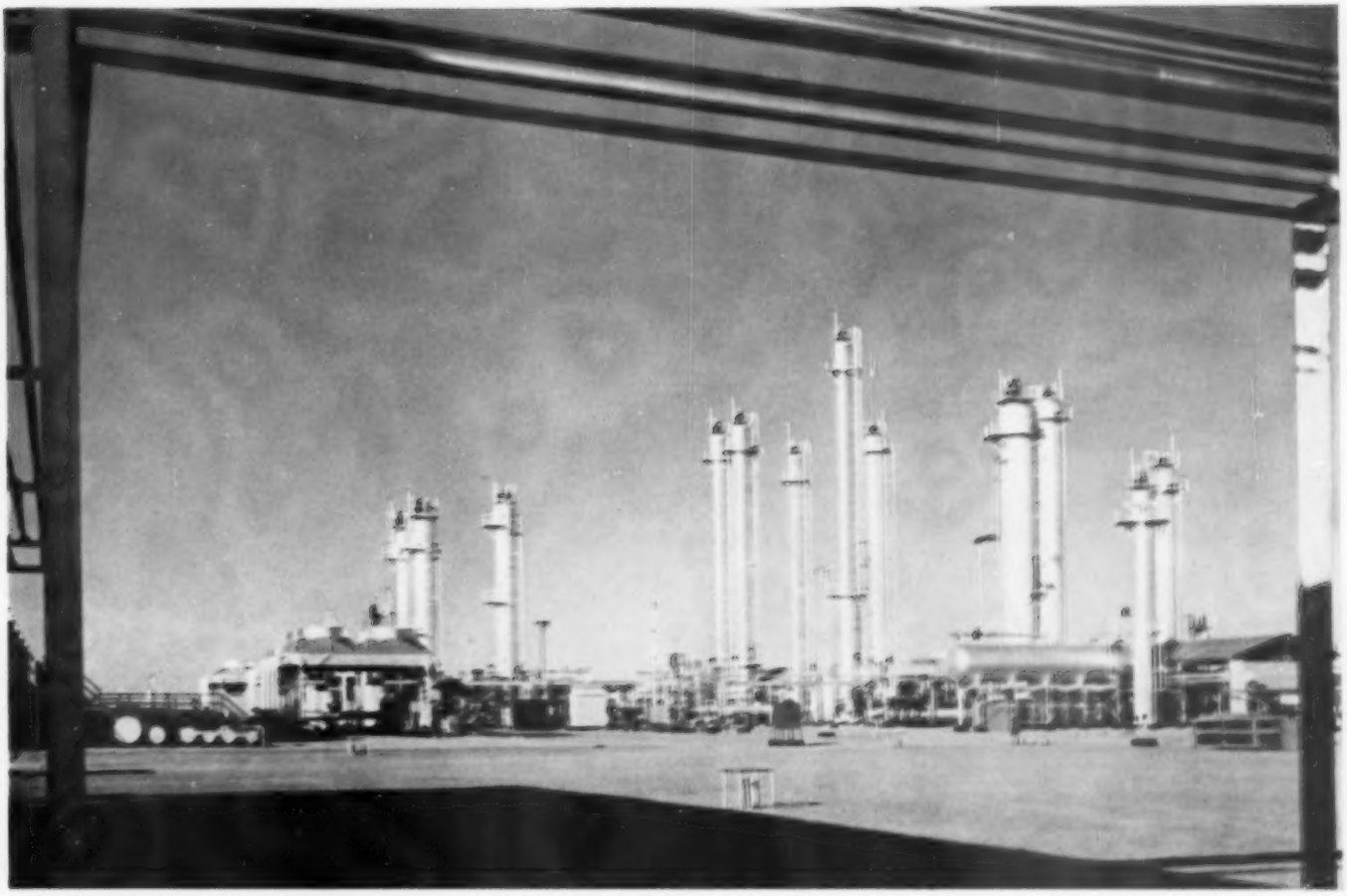

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